NOTE-BOOK

OF

MATERIA MEDICA,

PHARMACOLOGY, AND THERAPEUTICS.

BY

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PREFACE.

THE re-editing of this volume was begun several years ago by the late Dr Moinet. The first portion was printed off from his revision, and, in view of the probable appearance of a new edition of the *British Pharmacopœia*, it has seemed best to the Publisher that this part should be left untouched. The present Editors, therefore, have begun where Dr Moinet left off, and have incorporated the Addenda to the *British Pharmacopœia* partly in the text and partly in an Appendix. It is hoped that any confusion which this might give rise to has been obviated by careful indexing. Otherwise, the text and scope of Dr Scoresby-Jackson's original work have been as little interfered with as possible, so as to preserve the distinct individuality of the book. The organic Materia Medica has not been confined to official substances, many preparations recommended by the British Pharmaceutical Conference having been included, as well as all the substances scheduled by the Examining Board of the Pharmaceutical Society. The book will, therefore, it is expected, prove of special value to pharmaceutical students.

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NOTE-BOOK

OF

MATERIA MEDICA, PHARMACOLOGY, AND THERAPEUTICS.

PART I.—INTRODUCTORY.

MATERIA MEDICA.—This term, in its most restricted sense, signifies nothing more than the medicinal substances used in the cure of disease, and hardly extends beyond the domain of the druggist; but in a more liberal view, it embraces all the means at our disposal for the alleviation of the sufferings which attend disease,—except those involved in pure Surgery and Midwifery,—and includes all those *Hygienic* appliances which of late years have been so rapidly developed.

There is no law to define rigidly the scope and arrangement of a course of lectures on Materia Medica, and therefore, to a certain extent, the teacher is left to frame a plan according to his own idea of the relative importance of the various branches of his subject. The ultimate object of lectures on Materia Medica is to teach the legitimate use of means to an end. The centre around which the lectures are grouped is the *Physician's prescription.* From the utmost verge of the subject, the thread upon which it hangs leads back to the prescription, not of drugs only, but of everything that can alleviate suffering and cure disease. The ultimate object of medical education is to teach *how to write a prescription,* and in that little act lies the severest test of a physician's attainments. To be examined upon a prescription is to give access to every department of medical learning. If the student could satisfactorily explain the *how, what, when,* and *why* of prescribing, his education would be complete; but this is not to be attained during his *curriculum* merely, it is what the practitioner is still learning at the close of his career. The practical application of all the medical sciences culminates in the prescription; the ultimate object of Chemistry, Botany, Physiology, Pathology, and the other allied sciences, with respect to medicine, is to teach the physician how to apply the remedies at his disposal most advantageously to his patients.

Materia Medica is, as it were, surrounded by the medical sciences, so that in whatever direction we may advance we shall find ourselves approaching towards one or other of them. How far we may go without trenching upon the functions of another department, it is not easy to say. Attempts have been made to limit Materia Medica, and certain expressions have been coined to give it a locality. Such are—

Acology (ἄκος, *a remedy*, and λόγος) and *Iamatologia* (ἴαμα, *a remedy*, and λόγος), terms which signify *a discourse on remedies.* Acology has been limited by some authors to the consideration of those mechanical remedies, which, pertaining rather to pure surgery, it is not our province to deal with.

Therapeutics (θεραπεύω, *I cure*) relates to the application of Materia Medica, and varies in the extent of its signification according to the limits put upon the latter expression. It is divided into *General Therapeutics* and *Special Therapeutics.*

Iatreusologia (ἰατρεύω, *I cure*, and λόγος) signifies a discourse on the art of curing, a term applied by Sprengel to General Therapeutics.

Dietetics (δίαιτα, *diet*) is a term relating, in a restricted sense, to treatment by *alimentary substances*, but in a wider meaning, it is synonymous with *Hygiene* (ὑγιαίνω, *I am well*), a term relating to that department of medicine which treats of the restoration and preservation of health by means not strictly pharmacological. The agencies used in this department are the six *non-naturals* of the ancients, *air*, *aliment*, *exercise*, *excretion*, *sleep*, and *affections of the mind.* The term *Regimen* (*rego*, *I rule*) is included in this department.

Pharmacology (φάρμακον, *a medicine*, and λόγος) signifies a discourse on medicine, or Materia Medica. It is divided into *General Pharmacology* and *Special Pharmacology*, and is subdivided into *Pharmacognosy*, *Pharmacy*, and *Pharmacodynamics.*

Pharmacognosy (φάρμακον, *a medicine*, and γιγνώσκω, *I know*) and *Pharmacy* (φάρμακον, *a medicine*) are terms relating to the circumstances which affect the condition of simple and compound medicines during their passage from a state of nature to the physician's hand, viz., their source, collection, preservation, characters, qualities, purity, preparation, &c. The following terms are sometimes used synonymously—*pharmacography, pharmacomathy, pharmacotechny, pharmaconomia, &c.*

Pharmacodynamics (*Φαρμακον, a medicine*, and *δύναμις, power*, relates to the actions and uses of medicines.

Sources and Natural Condition of Medicines.—Medicines are derived both from the organic and inorganic kingdoms, from animals, vegetables, and minerals. Besides these we use certain subtile imponderable agents, such as electricity, galvanism, heat, cold, and the like. Medicines are called *simple* when used individually, *compound* when two or more are incorporated. But many simple remedies are constituted of several active ingredients, any one of which, when isolated, is capable of producing a distinct medicinal effect. Take *opium* as an example of an individual remedy in one sense, but truly a very complex substance compounded in the laboratory of nature. The ponderable substances, except mineral waters, are rarely met with in a condition ready for use. They usually require certain operations to be performed upon them in order to fit or preserve them for medicinal application. These changes are wrought upon them by the pharmaceutist.

The Selection and Collection of Medicines.—In selecting medicines from the mineral kingdom, we must be careful to understand and thoroughly examine their qualities, and obtain them as pure as possible. Beyond this we have no general rules to guide us.

Medicinal plants are collected from either wild or cultivated sources. Comparatively few are produced in this country, the rest are imported. Wild plants are collected from their respective haunts by men known as *Simplers*, between whom and the profession is the middle-man, drug-merchant, herbalist, or pharmacopolist. *Simplers* are of ancient date; they are the representatives of the *Rhizotomi* of the Greeks, and *Herbarii* of the Romans. Cultivated plants are grown in various parts of the world, the chief medicine-growing districts of this country being at Mitcham in Surrey, and Hitchin in Hertfordshire. The medicinal plants cultivated at Mitcham are chiefly lavender, peppermint, chamomiles, roses, liquorice, and henbane. Also large quantities of poppies, rosemary, squirting-cucumber, belladonna, and pennyroyal; and in smaller quantities, spearmint, marshmallow, horehound, foxglove, stramonium, &c. At Hitchin the cultivation is at present chiefly restricted to lavender, elaterium, belladonna, henbane, and aconite. The distribution and cultivation of medicinal plants, as indeed of all plants, are restricted by natural laws, which are explained in works on botanical geography. But we are interested in this matter in a double point of view. It is not enough for us to know that a medicinal plant will grow in a foreign land, and present the same external characters as it does in its native soil, we must know also that its medicinal properties are alike under both conditions. Another question of importance is whether a plant that is medicinal in its wild state will preserve the same properties under cultivation ; whether it is affected, medicinally, by the elevation at which it is grown, by its exposure more or less to light by the kind of soil in which it is planted ; whether it has the same medicinal value at all ages and at all seasons. In short, what is the effect of climate, soil, season, and cultivation upon medicinal plants? We have not much information to give in reply to this question. Much that has been stated in reference to it is vague and uncertain, and it is not easy to discriminate between the effects of one and another of these agencies.

We shall consider—1. *The natural condition of a plant.* 2. *How the plant may be affected by a change in its circumstances.* 3. *Examples quoted as evidences of the influence of such change of circumstances.*

1. *The natural condition of a plant.*—Plants are composed of *organic* and *inorganic* constituents. The *organic* constituents are common to all plants, and are four in number, Carbon, Hydrogen, Nitrogen, and Oxygen ; in some cases, two more are added, Sulphur and Phosphorus, which enter into the composition of the sanguigenous elements in alimentary vegetables. The organic constituents largely preponderate in the constitution of plants ; they are consumed when the plant is burned, and are decomposed by the united action of warmth and moisture. The *inorganic* constituents are comparatively small in quantity, are indestructible by heat, and do not undergo the process of putrefaction. They are not *universal, i.e.*, common to all plants although some of them are widely distributed. They are more numerous than the organic constituents ; they are Calcium, Magnesium, Potassium, Sodium, Iron, Manganese, Chlorine, Iodine, Bromine, Fluorine, Silicon, Sulphur, and Phosphorus. They vary in number and relative proportions in different plants, and do not exist in their elementary form, but are taken up as soluble sulphates, phosphates, chlorides, carbonates, silicates, &c., dissolved in water. Though small in quantity, they are essential to the building up of the tissues of the plant.

A few sentences must suffice to explain the nourishment and growth of plants, following a dicotyledonous example. After the dormant period of winter has passed, the tender fibres of the roots begin the process of vegetation, by absorbing from the soil a supply of aqueous fluid containing both organic and inorganic constituents ; and in the performance of this function they are endowed with the power of selection. As the process continues, this fluid passes through the stronger parts of the root to the stem, which it mounts by the softer external part, called *alburnum* or *sap-wood.* When the plant is in full vegetation there is a constant current or circulation of the fluid from the roots, where it is absorbed, to the leaves, where it is altered in character. In its ascent from the root to the leaves, the fluid consists of little more than a thin watery solution of the inorganic constituents, with some mucilaginous and saccharine matters dissolved from the plant in its progress, and is called *crude sap.* When this sap has arrived at the leaves or other green parts of the plant, it is exposed to the action of new agencies, namely, the atmosphere, heat, and light; and it undergoes an important change—(1) in losing a large portion of its water by *transpiration* or *exhalation;* (2) in the absorption and decomposition of carbonic acid gas, by what is called *respiration*, änd by which the carbon is provided to the plant; and (3) in the formation of certain organic products and secretions (including medicinal principles) by the process of *assimilation.* After these changes have taken place the fluid is called *elaborated sap.* When the sap is duly elaborated, it commences a downward course, along the *inner bark* or *cambium*, towards the root, adding new structures to the plant, and depositing its secretions in its course.

Such is a mere outline of the life of a dicotyledonous plant; but it is sufficient to suggest to us the modifications which medicinal plants may undergo according to the circumstances of their growth, namely,—

2. *How the plant may be affected by a change in its circumstances.* —*a.* There are certain constituents of a plant that are essential to its existence, without which it cannot thrive, and the absence of which is marked by the unhealthy appearance of the plant. There are other constituents that are always present under favourable circumstances, but which may be entirely absent without causing any external indication of the deficiency. Amongst the latter are medicinal principles. A plant which possesses medicinal properties when grown in one locality, may grow even more luxuriantly in another, and yet be deprived of its medicinal virtues—a change only to be recognised by analysis or by experimental application.

b. Many fruits and vegetables esteemed in our time have been gained by cultivation from repulsive ancestors, and saccharine and amylaceous principles have been developed in them, to the exclusion of their former sour and bitter ingredients. Hence fruits and vegetables are rendered more agreeable and nutrient by cultivation. But the medicinal principles of plants are often characterised by a bitter or other disagreeable taste, and sometimes by an offensive odour; and if the effect of cultivation be to alter these characters, it is probable that the medicinal virtue of the plant will also be modified to a corresponding degree. Hence, by analogy, we might infer that cultivated plants may be inferior to wild plants for medicinal purposes. But since long experience has taught the fruit and vegetable gardener how to improve his produce, it is probable that continued observation by our intelligent medicine cultivators will enable them to overcome whatever obstacles at present beset their path, to which end they will be stimulated by the measure of success that has already attended their meritorious efforts.

c. The soil in which medicinal plants are cultivated must contain the constituents essential to the building up of the plant and to the formation of its active medicinal principles. The absent constituents are to be supplied by manures, an operation demanding considerable scientific and practical acquirements, and great caution. For it is not only the deficiency of certain ingredients in the soil that interferes with the virtue of medicinal plants, the selective power of the plant itself also exercises an important influence. A medicine may be inert because of the plant having been deprived of some of its important constituents; but the loss of activity may also result from the plant having been too richly supplied with a certain kind of aliment which it selected in great abundance, to the neglect or exclusion of other essentials.

d. The climate must be suited to the habits of the plants, a circumstance over which the cultivator has no control. The two more important elements are temperature and light, which cannot be supplied together by artificial means. Exotics may be placed in hothouses whose temperature is equal to that of their native land; but the quantity and intensity of the light, and the corresponding solar influence of tropical regions, can never be reproduced in this country, and it is to them that the elaboration of the sap and the simultaneous formation of active secretions are chiefly due.

e. The age of the plant and the season at which it is collected affect its active properties. Medicinal plants are to be gathered when they are in full vigour. Until perennial plants have attained a certain age they have not laid up a sufficient store of active principles to make it worth while to destroy them; they are allowed to come to full vigour, but not to pass on to decay. Annuals are collected also in the vigour of life. The part of the plant to be used, as the leaf, the root, the bark, the fruit, the seed, determines the time of collection.

Roots may be gathered either in autumn or spring, before the development of the leaf, or after the ripening of the fruit. According to Dr Houlton, they should be taken up at the time that their leaves die, when they abound with the proper secretions of the plant. To this rule he allows no exception, but applies it equally to the roots of trees, shrubs, herbs, root-stocks, bulbs, cormi, and tubers. Biennial roots are to be gathered in their first year, as it is too late to collect them after the fall of the leaf in the second year, for by that time they are either dried up or decayed. Roots that are to be preserved should be dried immediately after they are collected. Large roots, especially the more juicy, dry spontaneously more readily in their entire state than when sliced, and their juices are then not exposed to the influence of the atmosphere, which is a matter of some importance. But many roots are dried in slices; and *bulbs* are first stripped of their outer layers, and then cut into transverse or longitudinal slices before drying.

Leaves are most vigorous, and contain their active principles in greater force when the process of flowering is somewhat advanced, but before it is fully accomplished. As a rule, they should be collected between the expanding of the flower and the ripening of the fruit. The leaves of *Aconitum Napellus* cause tingling and numbness in the lips, cheeks, and tongue, from their first appearance till the seeds begin to form; afterwards this property is lost, although the leaves still remain vigorous. Leaves may be either stripped from or dried with their stalks. When dried rapidly at 130° to 140° in a dark drying-room, until they crumble in the hand, they preserve their green colour and medicinal properties. Afterwards they are to be kept in closely-covered opaque jars, and powdered in quantities as required. The juices of leaves are less liable to deterioration by being inspissated in their own cells than they are by being formed into extracts, however carefully the process may be conducted. The drying of leaves is of no small importance, as upon the careful performance of this operation depends greatly their medicinal activity. It is important to preserve the colour both of leaves and flowers, for when the colouring matters are lost, other valuable principles go with them. The leaves of Digitalis, Belladonna, Stramonium, and other plants, contain less of their peculiar active principles when badly than when carefully dried.

Flowers are to be collected when they are partly or full blown. Some are collected soon after expansion has begun, and the *Rosa Gallica* is gathered before the bud is evolved, when the colouring and astringent principles are more abundant. Flowers are gathered at different times of day. If they are intended for immediate use, they may be collected either in the morning or in the evening; but if they are to be dried, they should not be taken when they are wet with dew or rain. When flowers are used for the sake of their odour, which arises from the presence of a volatile oil, they should not be gathered after they have been long exposed to the sun. The heat of the sun exhausts the odoriferous principle more rapidly than the plant can supply it, and in the heat of the day the odour of the plant is less powerful. They are suspended in bundles for drying, and are sometimes covered with paper to preserve them from the effect of light. Flowers should be dried promptly, but very carefully, and afterwards be preserved in well-closed opaque vessels.

Fruits are collected when nearly or quite ripe. If they are to be used immediately, they may be left until they are fully matured, but not until they have lost their plumpness, especially if the juices are prone to rapid change. If they are to be preserved in their fresh state, they must be taken a little earlier.

Seeds are taken when quite ripe, at the dehiscence of capsular fruits, and at the maturity of the pericarp in pulpy fruits. Seeds enclosed in *shells* should be preserved in them until required for use. Seeds require but little drying.

Woods are denser—and are said to yield more medicinal principles—in winter than at any other season. The wood of trees becomes denser if the bark be removed whilst they are standing, since the juices, then no longer finding their means of descent, become consolidated in the wood. A decorticated tree affords wood doubly rich in medicinal principles, not only because of its extra density, but also because it is found that trees deprived of their barks whilst standing become more quickly the prey of insects; and as these do not remove the active parts, weight for weight, such wood is more valuable than that procured in the ordinary way.

Barks are to be gathered when they can be most readily separated from the tree, either before or after the full development of vegetation, and not when the reproductive process is in activity. Spring is generally the most suitable time; and, as an example, oak bark contains more tannic acid at that period than at any other season.

Desiccation and Preservation of Medicinal Plants generally.—Medicinal substances derived from the vegetable kingdom are prone to deteriorations by keeping. They should be frequently examined, and all simple indigenous herbaceous plants should be renewed annually. If the plants could be obtained in the recent state at all seasons, there would be no necessity for preserving them ; but as this is not so, a store is to be laid up for use until a fresh supply can be obtained at the hands of nature. The first process in the art of preserving plants is to deprive them of their water of vegetation ; and this is to be done with the utmost care, so that as little as possible of their fugitive principles may be lost. Desiccation is conducted in an appropriate room, usually a loft at the top of the house, constructed in such a manner that a free current of air may pass through it, whilst neither the sun's rays, nor rain, nor even much daylight, can find access. Drying should be done as promptly as the means employed will allow; when it is conducted too slowly prejudicial changes are apt to take place in the juices. The water is to be abstracted, not driven, from the plants; and for this purpose three qualities are necessary to the atmosphere that is to absorb the moisture—*a certain temperature, dryness, and movement.* Warm air will take up more moisture than an equal volume at a lower temperature; and if the air be kept in constant transit through the room—in at one end and out at the other—the drying may soon be accomplished. The current of air should be directed in such a manner that it may approach from the warm or sunny side of the building, where it will derive additional warmth from the venetians heated outside by the sun. When artificial heat is used, great care is to be observed that the temperature be not carried too high, nor raised too suddenly, otherwise the plants may be rendered useless by being parboiled in their water of vegetation. The substances to be dried are spread in thin layers, or hung in garlands, and frequently turned. When the drying is finished, they are left inflexible and brittle; but after a time they recover a certain amount of water from the atmosphere, and become more flexible. When the quantity to be dried is not great, boxes of suitable construction are used instead of a large apartment. In some cases the less delicate plants are simply spread out in the open air in a shady place, protected only from the sun. When the medicinal property depends upon the presence of a volatile oil, desiccation should be conducted at as low a temperature as is consistent with the evaporation of the water.

3. *Examples quoted as evidences of the influence of such change of circumstances.*—The following have been mentioned by various writers :—Cinchonas that are grown on cold and exposed mountain sides are richer in alkaloids than others that are grown in close and unventilated valleys. Colchicum, which at all seasons in this country contains poisonous principles, has been eaten with

impunity in other countries in autumn, according to Krapf, Kraterhvill, and Haller; and Orfila states that he has frequently, in the month of June, given two or three corms to dogs without producing any peculiar results, and hence he supposed that the deleterious properties are modified by climate and season. Buchner held that the plant is most energetic in autumn, when the flowering stem is rising. Professor Christison believes it to be very energetic in spring, when it is watery, more membranous, shrivels much in drying, and is very bitter. *Opium*, *Senna*, *Mentha*, *Digitalis*, *Agaricus piperatus*, *Amanita muscaria*, *Myrospermum*, and many others, have been quoted as examples of the influence of climate either in modifying the sensible characters or affecting the nature of certain active poisonous principles in plants. The Indian variety of hemp, when cultivated in this country, grows well, attaining a height of ten feet or more; but it no longer possesses its narcotic properties, nor the resinous covering of its leaves. Haller states that Valerian, gathered in low situations from humid soil, is much less efficacious than that grown on the heights; and in almost all cases where the same plant grows both in high and low situations, those of the higher locality will be found to be more prominent in their characteristic features. The *Solanaceæ* and the *Cruciferæ* thrive best in the vicinity of animal life, and are far less vigorous when grown in an arid soil. Some of the *Umbelliferæ*, which are aromatic when grown in a dry soil, acquire poisonous qualities in a humid locality. Dr Christison mentions that *Cicuta virosa* and *Œnanthe crocata*, both umbelliferous plants, which are generally poisonous in England, are harmless when gathered in native localities near Edinburgh. Almost all powerfully odoriferous plants lose their odour in a sandy soil. Assafœtida is modified both in its botanical characters and medicinal properties by change of soil. Russian rhubarb is said to contain a much larger proportion of inorganic matter than East Indian or English rhubarb. Some plants thrive best in a dry and porous, some in a gypseous, some in a nitrogenous soil. The oil obtained from plants grown at Mitcham varies both in quantity and quality with the season and soil. Two adjoining acres seldom yield alike. This fact is perhaps more remarkable in the case of *Peppermint* than of any other plant grown there. Of two crops of this plant growing close to each other, that which is most luxuriant in appearance may yield the smallest quantity of oil; and between the oil obtained from plants grown at Mitcham and those grown at Carshalton, although they are adjoining parishes, there is a great difference both in quality and quantity

—a fact due to soil alone, since the care bestowed on the cultivation is alike in both places.

Some medicinal plants are improved by cultivation, but hitherto wild specimens have been generally preferred. The flower of the Chamomile, like that of many other plants, is doubled by cultivation, and its medicinal value thereby greatly deteriorated. Wormwood loses much of its bitterness by cultivation. It is generally stated that by cultivation, which renders its growth more luxuriant, the medicinal virtues of Aconite are impaired. Geiger stated that acrid varieties of Monkshood lose their acridity by cultivation; but Dr Christison affirms that this is not the case with the variety of *Aconitum Napellus* cultivated in the gardens and shrubberies of Scotland.

Plants vary considerably, both in physical qualities and in chemical composition, according to their ages. Young plants contain much water with mucilaginous principles, and at this stage of their existence can be used only to a very limited extent in medicine. At a later period their juices are more elaborated, and their secretions more complex. The different parts of plants vary also according to the age and condition of the plant. Barks are useless when too young, from not having had the necessary medicinal principles stored in them; and when too old their extractive matters become impaired, and their saline ingredients are exhausted by the rain percolating through their numerous fissures. Roots lose their succulent and flexible state, and become woody with age. In cases where the root bark is used, it is desirable that the roots should have attained a certain age; but where the substance of the root is used, it should be gathered while still flexible and containing duly elaborate juices. The narcotic principle of the poppy is not met with until the petals have fallen. The fruit of pimento changes the character of its flavour when allowed to attain maturity. Negroes feed upon the young shoots of a species of *Apocynum* without suffering any inconvenience, although, when fully developed, the plant contains poisonous and drastic principles. The clove is the unexpanded flower of *Caryophyllus aromaticus;* if it be allowed to expand, its peculiar taste and odour pass away, and they are not developed in the fruit. *Colchicum autumnale*, *Conium maculatum*, *Hyoscyamus niger*, and others, afford examples of the effect of age in modifying the medicinal properties of plants.

The Active Principles of Medicines derived from the Vegetable Kingdom.—We see, then, that there are several causes by which the medicinal properties of plants may be modified; and as these changes are effected chiefly through their *active principles*, it will be well for us to take a general view of the organic constituents concerned in the actions of medicines. When we regard the numerous substances of medicinal value that are formed during the growth of vegetables, remarking that, whilst they are frequently almost identical in constitution, yet they differ widely in their action when introduced into the human system, we see how much the physician is dependent upon the skill and accuracy of the pharmaceutical chemist. It is to organic chemistry that we owe the many elegant and powerful remedies of late years introduced into practice.

The organic proximate principles of which plants are composed, when resolved into their ultimate elements, are found to consist of varying combinations of Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulphur ; and according to the number of these elements, the number of atoms of each contained in the proximate principle, and the method of their arrangement, will be the nature and potency of the medicine thus derived. Some of the proximate principles of plants are exceedingly powerful, so as, in certain cases, to be poisonous in very small quantity ; whilst others are nutrient, and supply the necessities of the animal economy. Of the former class, we have the alkaloids, neutral organic principles, organic acids, volatile or essential oils, resins, &c. ; of the latter class, we have fixed oils and fats, starch, sugar, gum, and cellulose, besides the proteic or albuminoid compounds. We have space only for a word or two on each of these groups.

Alkaloids are, as the name implies, substances *like alkalies* (*alkali* and εἶδος, likeness), although they exhibit the properties of alkalies only to a limited extent. They are sometimes called *organic* or *vegetable* alkalies, the former because of their requiring a vital action to constitute them, and the latter with reference to their vegetable origin. The alkaloids are generally the most potent of the organic principles. They are for the most part solid and crystalline, but some are volatile. They are but sparingly soluble in water, more so in alcohol, and readily soluble in most of the dilute acids, and in ether and chloroform. The greater number are capable of restoring the blue colour to reddened litmus, and of forming with acids definite salts which are crystalline. Most of the alkaloids are quaternary compounds, consisting of C, H, N, O, in different proportions, but some few are ternary, and contain only C, H, N. Nitrogen is invariably one of their constituents. Various plants of the same natural family may yield a common alkaloid ; but, on the other hand, many plants of a common family may each contain a distinct alkaloid, whilst in some instances, as in opium, several alkaloids are met with in a single plant. The alkaloids are not met with in a free state in plants, but usually in combination with peculiar vegetable acids. All poisonous plants are believed to contain either an alkaloid or a neutral characteristic principle. It may be useful to remember that *most* of the alkaloids can be precipitated from solution, whether they be uncombined or in the form of salts, by *tannic acid*, and that, therefore, substances containing this astringent principle may be used generally as antidotes. A little confusion sometimes arises between the nomenclature of the alkaloids and of the neutral principles. The names of both are usually derived either from some peculiar property of the principle itself, or from the name of the plant from which the principle is first obtained. By some writers the last syllable is written indiscriminately *in* or *ia;* whilst others adopt the general rule of terminating the vegetable or organic alkaloids with *ia* and the neutral vegetable principles with *in.* Thus we have the alkaloids *Aconitia*, *Delphinia*, *Quinia*, *Morphia*, *Strychnia*, &c.; but in the last edition of the Pharmacopœia (1885), the termination *ia* of the alkaloid has been altered to *ina* thus *Aconitina*, *Quinina*, *Morphina*, *Strychnina*, &c., and the neutral organic principles, *Meconin*, *Guaiacin*, *Cusparin*, *Colocynthin*, &c.

Neutral Organic Principles.—These principles are usually ternary compounds, consisting of C, H, and O. Several of them are medicinal agents, whilst others appear to be almost inert. They are more or less bitter in taste, and when boiled with dilute sulphuric acid they yield glucose or grape sugar, and are hence termed *Glucosides.*

Organic Acids.—Vegetable organic acids exist as salts in the juices of plants in combination with potash, soda, lime, or an alkaloid; but they are occasionally met with in the free state. They are generally solid and colourless, and mostly crystalline; they are soluble in water and alcohol, and in combination with bases form definite crystalline salts. Some volatilise readily when moderately heated in air, and all are decomposed when heated in closed vessels. Some of the acids, as tannic, are widely diffused through the vegetable kingdom, whilst others, as meconic, are restricted to a single family. Some of the vegetable acids are *educts*, others are both *educts* and *products*; or, in other words, some exist naturally as proximate principles of the plant, and can be separated by simple processes, whilst others, although in the same manner existing naturally in plants, may also be produced artificially from other organic materials. All the acids contain oxygen except *hydrocyanic*, which is the only one containing nitrogen.

Volatile or Essential Oils.—These oils are largely used in medicine for a variety of purposes, besides that of imparting an agreeable taste and odour to offensive drugs. They are found most abundantly in the leaves and flowers of plants, from which they are obtained by distillation with water, or, in some instances, by expression from the cellular structure. The delicate and fugitive character of some of these oils demands most careful attention to the process of distillation. Volatile oils, when quite pure, are believed to be invariably colourless, though some have never yet been obtained in that state; and all, when exposed to air and light, readily assume a certain colour. Their odour is similar to that of the plants yielding them, but they are seldom agreeable in the concentrated form. The readiest way to ascertain the true odour is to rub a drop on the hand, and then breathe upon it, or allow a little to be diffused through the air of an apartment. The essential oils, owing to their value, are greatly subjected to adulteration. By careful fractional distillation they may be separated into two parts, called *Elœoptene* and *Stearoptene* (ἔλαιον, *oil*, στέαρ, *fat*, and πτυνός, *volatile*), which have different specific gravities. The former of these is frequently a *hydrocarbon*, and the latter an *oxyhydrocarbon*, which in some instances is concrete, and frequently has the composition of ordinary camphor. The volatile oils may be chemically defined as:—1. *Hydrocarbons* or *Camphenes*, constituted of C and H. Of this group oil of turpentine may be regarded as the type, with which, although their sensible properties vary considerably, the oils of lemon, bergamot, orange, juniper, and others, are isomeric. 2. *Oxyhydrocarbons*, containing, in addition to C and H, oxygen, which may exist either in both the Elœoptene and Stearoptene, or in the latter only. These oxygenated essential oils are the most soluble of the volatile oils in alcohol and water, and are extensively used in the form of medicated waters. This class includes also camphor and its modifications. 3. *Sulphuretted* and *Nitrogenated Oils.*—Many of the plants containing these oils are used for culinary purposes, as horse-radish and garlic. Except assafœtida, sagapenum, and garlic, all the oils of this class are derived from the *Cruciferæ*. There are a few volatile oils which contain nitrogen in the form of prussic acid; they are chiefly derived from the sub-order *Amygdalæ* of the *Rosaceæ*.

Resins are widely diffused through the vegetable kingdom, and are obtained either by spontaneous exudation, or by incisions made into the bark or wood of trees and shrubs. On exposure to the atmosphere the essential oil with which they are united either evaporates or solidifies by oxidation, and the resin resumes its hardened form. They are usually constituted of different resinous principles, which are capable of separation. The resins are dry, brittle, of varying taste, odour, and colour, all of which characters are probably due to the presence of ingredients not truly resinous; they are readily fusible and very combustible, and become electric by friction. They are insoluble in water, more soluble in hot than in cold alcohol, and they are deposited from their solution on the addition of water, the water assuming a milky appearance. Most of them are soluble in ether, and in the fixed and volatile oils. Being insoluble in water, the resins cannot be prescribed with that alone, but may be made into *emulsions* by the addition of a little oil and gum, or yolk of egg. Resin of scammony may be given in milk or almond emulsion. In their medicinal effects the resins usually, but not invariably, resemble the essential oils to which they correspond. When they retain a considerable quantity of essential oil, they preserve a semi-liquid form and are called *oleo-resins* or *terebinthinates;* but when hard and brittle, from the loss of the oil, they are *resins proper.* When *benzoic* or *cinnamic* acid enters into their constitution they are called *balsams*, and the admixture of gum separates them into the class of *gum-resins.*

Extractive.—Formerly, when plants possessed medicinal properties which could not be attributed to any recognised proximate principle, their actions were said to be due to the *extractive principle*—a term applied to a substance widely disseminated through the vegetable kingdom. The substance thus named, and even now ill-defined, gradually diminished in importance, as more complete analysis showed the presence of definite proximate principles, to which the actions of the plant as a medicine became referable. Formerly the extractive principle was presumed to be the common basis of all extracts, but subsequent investigations proved that it was not a simple principle, but a heterogeneous mixture of matters peculiar to individual plants. It is intimately associated with, and frequently contains, but does not constitute, the active principle of the plant. It is recognised by its amorphous condition and brownish colour, by its distinct but variable taste, its solubility in water and in weak alcohol, its insolubility in absolute alcohol and in ether, and by the rapid change which it undergoes when exposed to the air—all of which characters, however, are more or less modified according to the source of the extractive. Seeing that this substance forms a part of very many medicinal plants, it must enter also into many pharmaceutical preparations, from which, however, may be excluded the following,—namely, solutions made with strong alcohol, ether, and oils, because it is insoluble in these menstrua; and prep made by distillation, because it is not volatile.

Fixed Oils and Fats.—These ternary non-nitrogenised orga ciples, derived from the vegetable and animal kingdoms, are used both as articles of diet and as medicines. When take nally they operate as nutrients, alteratives, demulcents, or cat whilst externally they are applied as emollients, and are larg also as vehicles for more powerful medicines. They are to adulterations—the fine or superior varieties with the qualities.

Saccharine Principles.—These substances, of ternary comp exist both in vegetables and animals. They are characteris sweet taste, solubility in water, and, under certain circumstan their decomposition into alcohol and carbonic acid. Th varieties of sugar are:—cane sugar (sucrose), grape sugar (g fruit sugar (fructose), and sugar of milk (lactose). In a var forms, sugar is administered both medicinally and as an of diet.

Starch.—This ternary compound exists largely in plants, esp in the seeds and in the underground tubers and bulbous There are many varieties, of which the chief are wheat- potato-starch, rice-starch, arrowroot, sago, and tapioca. Sta convertible into dextrine and grape-sugar. It is a valuable t the presence of iodine, with which it forms a characteristic compound.

Gum.—There are several varieties of this ternary principle able from the vegetable kingdom, either by spontaneous exud or by incisions into the barks of trees. The varieties are not r distinguished; they have been classed into soluble gums, and which swell up in cold water; of the former of which *Arabine* type, and of the latter *Tragacanthine* or *Bassorine*.

Pectose, Pectin, Pectic Acid, Vegetable Jelly.—*Pectose* exists in succulent roots and acidulous fruits of many plants, and is conv by the organic acids, and by heat and light, into a soluble gelat substance called *pectin*, *parapectin*, *pectic acid*, &c. Pectin is fo during the ripening of the fruits, and gives the gelatinous char to the juices of currants, raspberries, &c., and also to the juic some medicinal roots, such as gentian, dandelion, &c.

Cellulose, Lignin, Woody Fibre.—*Cellulose*, or *cellular matter*, i organised substance, without colour, taste, or smell, translucent w freed from foreign matter, and medicinally inert, occupying the walls of plants, and forming the pure base of woody fibre. I arly insoluble, and by the aid of sulphuric acid is convertible into xtrine. It is as much as possible excluded from nearly all pharma-utical preparations used internally, but lignin is used externally in e form of cotton and lint, and enters into the compounds *pyroxylin* un-cotton) and *collodion*.

Proteic or Albuminoid Substances.—Besides the ternary proximate inciples already enumerated, there are in all plants and animals rtain neutral nitrogenous compounds, consisting of C, H, O, and for the most part in combination with sulphur and phosphorus. ulder was the first to point out the general resemblance between ese bodies, as existing in the vegetable kingdom, where they are presented by *glutin*, *albumen*, *casein*, or *legumin*, and in the animal ngdom, where they are met with as *fibrin*, *albumen*, *casein*, and *atin*, their constitution being almost identical in both kingdoms. ith the exception of *gelatin*, these substances are said to be deriva-es from a common principle, *protein*, which, according to Mul-r, consists of $C_{18}H_{25}N_4O_5$, but according to Liebig and others, of $H_{36}N_6O_7$; and it has been supposed that this principle, in com-nation with various proportions of sulphur and phosphorus, yields e above-mentioned and hence so-called *proteic compounds*. These inciples, according to the modern chemical theory, form what are lled the *flesh-forming* articles of diet, as distinguished from the on-nitrogenous ternary compounds, starch, sugar, and gum, which e said to be merely *heat-producing* substances. Although their mposition is well understood, yet no definite chemical formulæ ve been constructed to represent their constitution; but it is own that they readily undergo decomposition when exposed to isture and a certain temperature, being converted into water, nmonia, carbonic acid, and other inorganic compounds. When ese principles are in a putrefying condition they act as ferments to any organic substances, whereby a large number of the permanent armaceutical preparations would be destroyed were not these otein compounds removed by coagulation or precipitation.

PHARMACEUTICAL OPERATIONS.

As a general rule, medicines are not obtained from nature in a ndition fitted for immediate use: almost all medicinal substances, cept mineral waters as a class, require to undergo certain processes prepare them for administration. The operations performed upon em may be either mechanical or chemical.

The following—in alphabetical order—are the principal pharmaceutical processes, but including only such as are not commonly treated of in courses of lectures on chemistry :—

Clarification.—The removal of substances which impair the transparency of liquids. Heat is commonly employed for this purpose, as in the clarification of honey; the honey is melted in a water-bath, whereby the impurities are set at liberty, and may be either removed by subsidence, or by skimming, according to their density, or by filtration. But clarification is more commonly effected by means of albumen with the subsequent application of heat. White of egg is used for this purpose : it is first mixed with a little water and then added to the *cold* liquid, care being taken to diffuse it equally through the liquid before the application of heat. The temperature of the mixture is then gradually raised until the albumen coagulates, in doing which it seizes the impurities suspended in the liquid, and either floats or subsides with them according to their combined density, as compared with that of the fluid.

Comminution.—The process by which vegetable substances are broken into coarse pieces, as in the preparation of infusions and decoctions. This operation is effected by means of the *cutting, slicing, rolling, or cradle-knife,* when the substance is easily cut; but if it be dense and hard, as wood, roots, barks, &c., as a preparatory operation to powdering the *chopping-trough* is more suitable.

Contusion.—The process for powdering hard and tough substances. It is effected by means of the pestle and mortar, handworked if the quantity to be operated upon be small, but if large, the pestle is worked by machinery.

Crushing is an operation performed upon recent herbs to obtain their juices for various purposes. This process is sometimes effected by means of a pestle and mortar; but when the substance is in large quantity, it can only be accomplished by the aid of a *drug* or *pugging mill.*

Crystallisation.—Many medicinal substances are directed to be kept in the crystalline form. It is the state in which they are least subject to adulteration; and the crystal is one of the chief characters by which we recognise them. Crystals are beautifully regular mathematical forms assumed by certain substances in their passage from a gaseous or liquid to a solid state. They are sometimes obtained from volatile substances by sublimation or by fusion; but far more commonly either by the gradual evaporation of the fluid in which the substances are dissolved, or by some chemical interference forming a new substance which the solvent is no longer capable of retaining. The hot and saturated solution from which crystals are generally obtained is first strained, and then "set aside to cool and crystallise." The finer crystals are obtained by the very slow, gradual, and uniform evaporation of a thoroughly strained solvent; and they are still finer if the concentration previous to the setting aside has not been carried too far. If the previous concentration is continued until a pellicle forms on the surface of the solution, the subsequent crystallisation is effected more hastily, and the crystals are seldom distinct. The liquid that remains after the formation of the crystals is called the *Mother Liquor*, which still contains some of the substance in a concentrated form, in combination with any impurities that may have escaped the filter. According to the value of the substance, the mother liquid is either rejected or preserved for use in future operations. Some substances which crystallise with difficulty are obtained by *granulation*. This is done by constantly stirring the solution during its evaporation. Most crystals contain a definite quantity of solidified water called *water of crystallisation*, or when it replaces a base, *water chemically combined*. Salts are called *deliquescent* when they absorb water from the atmosphere; *efflorescent* when they part with their water spontaneously; and *permanent* when they neither absorb nor give off water. Compounds containing water in definite proportions by weight are called *hydrates* (not to be confounded with *hydrides*, in which hydrogen is a constituent). Compounds which do not contain water, or from which it has been driven off by artificial processes, are called *anhydrates*. For the *systems* and other particulars of crystals, I must refer the student to works on *Crystallography*.

Decantation is the separation of a supernatant liquid from a precipitate or sediment collected at the bottom of the vessel. In this operation two things are to be guarded against—spilling the liquid, and disturbing the deposit. The following means are employed to facilitate this simple-looking but often difficult operation :—(1) the guiding rod ; (2) greasing the rim of the vessel from which the fluid is to be poured ; (3) the syphon ; (4) the pipette ; (5) the syringe.

Decoction.—See *Decocta* amongst galenical preparations, and also the following article—*Digestion.*

Digestion is the process for dissolving a medicinal substance in a menstruum by the aid of sustained heat. The terms Maceration, Digestion, and Infusion are often used indiscriminately. They have the following relative signification :—*Maceration* is when a solution is made with the menstruum at the ordinary temperature of the atmosphere (*cold infusion*) ; *Infusion* (*except cold infusions*) is when a solution is made with the menstruum originally at the boiling-point, but allowed to cool gradually; *Digestion* is when a solution is made with the menstruum a little below the boiling-point, but sustained at that temperature for a prescribed time—a process analogous to that of *simmering*. *Decoction* differs from the former process in this, that the menstruum is kept at the *boiling-point* for a given time, and is then allowed to cool gradually.

Displacement or *Percolation* is a process which has been gradually superseding that of *maceration*. The difference between the two processes is simply this, that in *maceration* the substance from which the desired ingredients are to be dissolved lies in the menstruum for a certain time; whereas in the process of *percolation or displacement*, it is suspended in the course of the menstruum which abstracts the desired ingredients as it filters through it. *Percolation* (*percolo*, to strain through) signifies nothing more than filtering in such a manner that all the menstruum shall come in contact with the whole of the contents of the filter; the object being not to remove impurities from the liquid, but to obtain a medicated filtrate. The term *displacement* relates to the fact that the fluid with which the substance is saturated can be displaced, under favourable circumstances, either by the addition of more of the same, or of another suitable fluid. A variety of instruments are used for this process, the rationale of which is this:—The substance to be operated upon is first reduced to a convenient state of division, and is then placed in a cylindrical vessel of such proportions that the height of the column shall be more considerable than the breadth, in order that the menstruum, as it passes through, may come into contact with as many layers as possible. Within the cylinder is a perforated diaphragm, which allows the passage of the menstruum after it has percolated the substance; but which, whilst it serves as a support to the latter, prevents its escape at the bottom of the cylinder. The lower part of the cylinder is contracted, so as to be under the control of a tap or a cork, and is adapted to a vessel suitable to receive the filtrate. The menstruum is then poured in certain quantities upon the substance in the cylinder, and so soon as it begins to drop into the receiver below, the process is either checked for a little while by a tap or cork at the lower end of the cylinder, or, if not, that which passes through first is sometimes returned to the cylinder to perform its work a second time. It is generally considered better to moisten the substance previous to packing it in the cylinder or percolator. Unless the process be well conducted the result will not be satisfactory. The chief points to be regarded, and which I cannot here dwell upon, are—(1) the state of division of the substance, which varies for different substances ; (2) the degree of firmness with which it is packed ; (3) the uniform permeation of the menstruum—care being taken to avoid its passage by *channels* or *interstices*. See *Tincturæ*.

Distillation.—The object of this process is to separate volatile from fixed ingredients in solution. It is analogous to the *sublimation* of dry substances. It differs from evaporation in its object—that of distillation being to preserve the volatile part, whilst the intention of evaporation is to dissipate it. The process is effected by the aid of heat and cold. The solution is heated to a temperature sufficient to convert the required part of it into vapour, which is carried to a separate part of the apparatus, to be again restored to its fluid form by the influence of cold. The temperature at which the process is carried out will depend upon the volatility and inflammability of the liquid to be operated upon. Sometimes a substance may be separated into several parts by a gradual increase of temperature, the part which is volatilisable at the lowest temperature passing over first (this is termed *Fractional Distillation*). Many of the officinal *waters, spirits*, &c., are prepared by distillation.

Destructive Distillation is a process conducted apart from atmospheric influence, whereby organic bodies, being subjected to a high temperature, lose their original form, and yield new products.

Elutriation is a process by which powders may be separated into quantities of different degrees of fineness. The powders to be operated upon are suspended in water—which must neither dissolve nor act chemically upon them—are carefully diffused through it, and the whole is allowed to stand for a little while. During this period of repose the heaviest particles sink to the bottom ; the fluid is then decanted, leaving the coarser powder behind, which, when dried, forms one of the desired qualities. By repeating this process, each time allowing a longer period of repose, the powder may be reduced to the last degree of fineness. In this way also impurities, differing in intensity from the true powder, may be removed.

Evaporation.—Vaporisation is the conversion of fluid substances into vapour. It may be effected at various temperatures, according to circumstances. If the atmospheric pressure be removed, as when evaporation takes place under the bell of an air-pump, a very low temperature is required ; and from this the process may be conducted at any temperature up to the boiling-point. Evaporation is used in the manufacture of many of the galenical preparations, but its most common application is to the preparation of extracts, under which it will be mentioned again.

Filtration.—This is a process for the separation of solid particles from the fluids in which they are held in suspension. For this purpose the liquids are passed through media of different degrees of porosity, according to the fineness of the particles which are to be kept back by their intervention. These media, called *Filters*, are made of different substances, and are constructed and supported in various ways to suit circumstances. In some cases organic materials are used, such as *woollen cloth*, *flannel*, *linen*, *calico*, and different qualities of *paper;* in others, inorganic materials are employed, such as *sand*, *powdered glass*, *powdered rock*, *crystal*, *prepared asbestos*, *charcoal*, &c. *Straining* differs from *filtering* only in being conducted with less care and greater rapidity; it is used when the entire separation of the solid particles is not essential. The object of filtration may be either to purify a liquid, discarding the solids; or it may be to obtain the solid contents, the liquid being unimportant; or it may be to separate them and preserve both. When the solid substance is a powder which, by its density, sinks in the liquid, it is called a *precipitate*, and the liquid separated from it by filtration is termed the *filtrate*.

Granulation.—Some of the metals, as zinc, tin, and others, are reduced to different states of division by this process. The operation varies according to the properties of the metal to be divided, and the condition required. Zinc may be melted and poured into water, by which it is coarsely divided; or it may be melted, and in this state be rubbed in an iron mortar until it is solidified, by which process it will be obtained in finer particles. Tin may be granulated by pouring it, in the molten state, into a strong wooden box, closing the lid firmly, and shaking it until it becomes solid. For the granulation of powders—see *Powders*.

Infusion.—See *Infusa* amongst galenical preparations; see also under *Digestion*.

Levigation.—The process of rubbing substances between two hard surfaces to reduce them to very fine powder. The substance to be operated upon is first formed into a paste by means of water, which constitutes the only difference between this process and *trituration*, for which no liquid is required. Substances that are powdered by levigation are sometimes formed into little conical masses, to facilitate the drying, of which we have an example in levigated chalk.

Lixiviation is the process used for the separation of the soluble from the insoluble parts of certain bodies, as in the preparation of soapmaker's ley. It is a form of the process of solution by percolation or displacement.

Maceration is the process for dissolving medicinal substances in liquids at the ordinary temperature of the atmosphere. The substance to be operated upon is previously prepared by comminution or coarse powdering, and the solvent called the *menstruum* is then poured over it. In this condition the ingredients are allowed to remain for a period varying from half an hour to several days, according to circumstances. Substances containing volatile principles that would be driven off by heat, and others which would yield undesirable ingredients to hot liquids, are prepared by maceration. The cold infusions, and most of the tinctures, are so prepared. Maceration is somewhat superseded by displacement or percolation. See *Digestion.*

Porphyrisation is a form of *trituration,* the substance being reduced to fine powder by rubbing it between a porphyry slab and muller. The substance to be operated upon is first coarsely powdered, and is next made into a moist tenacious paste, or *magma*, by the addition of water, if that liquid does not act injuriously upon it. The muller is then worked in a regular curvilinear manner over thin layers of the mass. This method is not much used.

Precipitation is the process by which a solid substance may be separated from a fluid in which it was previously dissolved, the solid thus separated being either in the form of crystals, amorphous powder, or magna (a moist, tenacious mass). The substance may either fall to the bottom, be diffused through the liquid, or float on its surface; but more commonly, as the name implies, it is thrown down. The substance is called a *Precipitate,* and the agent which produces it is called the *Precipitant.* Precipitation may be caused by chemical or other changes which affect solubility. When two soluble chemical substances, having an affinity for each other, are brought together in solution, if between them they contain the elements of an insoluble compound, it will be formed and precipitated. This it is important to remember in the construction of magistral formulæ. Precipitation may also be caused by physically interfering with the solvent powers of the liquid; thus, there are certain alcoholic solutions which throw down their contents on the addition of water. Several of the tinctures are thus affected.

Pulverisation.—The powdering of drugs is chiefly executed by wholesale drug-grinders, whose *mills* are adapted to perform the operation in a suitable manner, and upon quantities equal to the enormous demand. In smaller quantities drugs may be reduced to a state of division suited to different circumstances by any of the following processes :—*Contusion*, *trituration*, *porphyrisation*, and *levigation*. All drugs before they are sent to the mill should be *garbled*, that is, all adulterations and inferior pieces should be rejected, and none but the best specimens should be allowed to undergo the operation of grinding. It is very difficult to pronounce the quality of some drugs when in a state of powder, and the best guarantee of their purity is a careful selection of pieces previous to grinding. Great care should also be taken in the process of drying the substances as a preliminary step to grinding ; otherwise their medicinal activity may be greatly impaired by this part of the operation. In spite of all care, however, in the case of drugs possessing fugitive principles, there is always a certain deterioration. But when the substance contains a good deal of water, and is not readily injured in its properties by a drying heat, its strength is increased by powdering, that is, weight for weight ; the relative increase of strength being equal to the loss of water. Powdered opium is an example of this. Powders are apt to be contaminated in their passage through the mill by admixture with the remnants of the substance previously ground, unless the rollers be carefully cleaned after each operation.

In some cases it is necessary, in order to reduce a substance to powder, to operate upon it in the presence of another substance, whose sole object is, by its greater hardness, to separate the particles of the drug. This agent is called a *medium* or *intermedium*, and the process is termed *mediate* or *intermediate pulverisation*. The degree of fineness to which a substance is to be powdered is a matter of importance. The more minutely a substance is divided, the more readily and powerfully it will act on the system ; but substances containing delicate and fugitive principles are apt to be rendered inert if the pulverisation be carried too far.

Very fine powders may be obtained by the process of *dusting*. This may be effected by passing the finer particles of the powder through a lawn sieve, as in the *dusting-bottle ;* or by means of a gentle current of air, so directed as to convey the lighter particles to a convenient receptacle during the operation of grinding or triturating. *Sifting* is merely a part of the process of pulverisation. When the substance has passed between the rollers, it is transferred, in portions, to the *drum-sieves* or sifting apparatus, which is generally worked by the same machinery as the rollers. The particles which are too coarse to pass through the sieves are returned to the mill.

Solution.—This process may be either of a simple or a complex character. It is *simple* when the substance dissolved can be recovered without having undergone any change ; and it is *chemical* or *complex* when the substance is changed in its nature, so that on the evaporation of the solvent, or its removal by other means, it cannot be recovered in its original condition. Many of the officinal compounds are prepared by *chemical or complex solution*, as in the case of *Liquor Ammoniæ Acetatis;* but many others are prepared by *simple solution*, the object of which is merely to overcome the attraction of aggregation in the solid body, and to reduce it to a state of the finest division. In this form medicines are more readily taken into the system than in any other; because, either within or out of the body, they must undergo solution before they can be taken into the circulation. The fluid used to dissolve the substance is called a *solvent* or *menstruum*. Of these, several are ordered in the Pharmacopœia—as water, at various temperatures, rectified and proof spirit, sherry, ether, &c.—for the preparation of infusions, decoctions, solutions, tinctures, and wines.

The term *Saturation* has both a strictly chemical and a pharmaceutical or physical signification. In the former sense it is synonymous with neutralisation, as when a certain quantity of acid is said to saturate or neutralise a given quantity of alkali. But when a liquor has dissolved as much of a solid substance as it is capable of taking up, the solvent is saturated in the physical sense. And it is to be remembered that when a solvent is saturated with one substance, so that it cannot take up any more of the same, it is still frequently available as a solvent of a different substance.

Sublimation—the vaporisation of solid substances, or, as it is sometimes called, *dry distillation*—is the process by which volatile principles, either previously existing or occasioned by the process, are obtained from dry substances. The process is conducted by the successive application of heat and cold to the substance. By the former the volatile principles are converted into vapour, and by the latter the vapour is *condensed* into the solid form. Calomel, corrosive sublimate, benzoic acid, camphor, &c., are prepared by this process.

Trituration is one of the processes applied to the pulverisation of drugs. When the substance is small in quantity, trituration is performed by means of the pestle and mortar, either worked by hand or by machinery. *Porphyrisation* and *levigation* are modifications of trituration. On a large scale, drugs are powdered by grinding. See *Pulverisation*.

Washing.—Impurities may be removed from precipitates, crystals, &c., by *washing*. This may be done by passing a stream of water, or other fluid, over them, projected from one of the *wash-bottles* so common in chemical and pharmaceutical laboratories.

Weights and Measures.—We cannot advance a step in our subject without a knowledge of the operations of weighing and measuring, and acquainting ourselves with the relative value of the different weights and measures. There are no processes in more frequent use than weighing and measuring. A steady hand, quick eye, and keen preception, combined with careful and dexterous manipulation, are essential to the performance of these operations; and such qualities on the part of the operator will be unavailing unless they be supported by clean and accurate instruments.

There is at present no universal standard by which the weights and measures of different countries can be tested. Attempts have been made to reduce them to a common denomination, fixed by an immutable standard; but hitherto these attempts have been unsuccessful. The *metrical system* of weights and measures has been adopted in many countries, and is now in its *permissive* stage in the United Kingdom. It is much more suitable than our ordinary system for analytical purposes, and is generally adopted by scientific men. The danger involved in introducing into the mixing and dispensing of medicines a system of weights and measures, as yet comparatively unknown and ill-understood in this country, has, however, deterred the authors of the British Pharmacopœia from giving it even as an alternative method, with the single exception of the formulæ for volumetric estimations. Its many advantages will doubtless bring it ultimately into general use. But with this we have not to deal; it is sufficient that we guard ourselves against errors that would lead to mischievous, if not dangerous, results in the preparation of simple and compound medicines.

The Balance.—For weighing substances that differ much in volume and density, several balances are required. For ordinary purposes in preparing and dispensing medicines at least three are necessary—one for grains and parts of a grain; one for ounces and upwards; and one for pounds and upwards. For analytical purposes the balance must be exceedingly accurate and sensitive, so that one-hundredth of a grain, or less, added to one of the pans, may be decidedly appreciable. The Royal Society of London possesses an instrument, made by Ramsden, which will turn with the one-hundredth of a grain when loaded with ten pounds weight; and another instrument, by the same maker, is said to show a distinct movement on the addition of one sixteen-hundredth of a grain when loaded with five ounces. But for general pharmaceutical purposes a much less delicate instrument is needed; and for ordinary dispensing purposes, a balance turning readily with the tenth of a grain is sufficiently sensitive. For coarser weighing stronger and less delicate instruments are used.

The lever of the balance should be inflexible, and the balance should never be overweighted. A balance that has been constructed to weigh parts of a grain should never be loaded with ounces, nor an ounce balance with pounds, otherwise the instrument cannot afterwards be depended upon for the smaller quantities.

The arms of the lever must be exactly the same in length and weight, otherwise the result of the weighing will be incorrect. The smallest difference with respect to the length of the arms will lead to error; but unless carefully examined and tested, an imperfection of this kind may be overlooked. The unloaded pans of an instrument having this imperfection may be apparently in perfect equipoise, and yet substances weighed in them will not afford the same results when the operation is conducted in a standard instrument. To guard against error, or to make use of a balance known to be of unequal arms, the following plan may be adopted:—Weigh the substance carefully, either by weights, or by means of any finely-divided substance, such as sand or small shot; then remove the substance from the pan, and restore the equilibrium of the balance by standard weights, which will accurately indicate the weight of the substance replaced by them. This is called *Double Weighing.* To ascertain whether a balance has this imperfection or not, it is only necessary to weigh some substance carefully, and then transpose the weights and the substance; if the results be the same, the balance is correct. Other points of importance in the selection of a balance are chiefly these: that the fulcrum be placed above the centre of gravity of the beam, that the fulcrum and the suspension points of the scales be exactly on the same level, and that friction be reduced to a *minimum.*

WEIGHTS may lead to errors from two causes: first, from not having been correctly made; and second, from loss of a portion of their substance through *wear and tear.* A set of standard weights should be carefully preserved for occasionally testing the weights in use. When in use, both the balance and weights must be kept from the effects of substances capable of injuring them, such as powerful chemical reagents. When not in use they are to be kept in a suitable case, free from dirt, and protected from rough usage.

MEASURES.—Up to a certain capacity, the measures used in pharmacy are commonly made of glass; beyond that they are made of metals. Like weights, measures are often incorrectly made; and when graduated they are not unfrequently erroneously marked. Glass measures have the advantages of transparency, cleanliness, and of remaining unaltered in capacity. Metallic measures are liable to indentation, which obviously alters their capacity. With an accurate balance and weights the capacity of measures may be readily tested. All that is necessary to be done is to place the suspected measure upon a perfectly smooth and level surface, pour into it a certain quantity of distilled water, at the temperature of 60° Fahr., until it reaches the mark to be tested, and ascertain the weight of the water. A gallon measure should be accurately filled by ten pounds of water; a pint measure by 1·25 pounds of water; a fluid ounce measure by one ounce; a fluid drachm measure by 54·68 grains; and the space occupied by a minim is equal to that occupied by water weighing 0·91 of a grain.

In dispensing medicines, the measure next in capacity to the quantity to be measured should be used. Because, however accurate the graduation may be, where the area of the measure is large, it is impossible to determine exactly the quantity in the measure. Thus a drachm should be separated by means of the one or two drachm measure, not by the ounce measure; an ounce by the ounce, not by the pint, measure.

The Minim and the Drop.—Sixty minims make one fluid drachm, but sixty drops may be either more or less than a fluid drachm, according to circumstances. The size of a drop—that is the smallest quantity of liquid that will fall by its own gravity—is susceptible of modification by several circumstances. The quantity of fluid contained in a drop varies, for example, according to the size and shape of the vessel from which it is poured; its viscidity, the rapidity with which it is dropped. This is especially the case with tincture of opium or laudanum, a drop of which is usually considerably smaller than a minim. Drops of different liquids also vary in size to a considerable extent, so that a *poured* drop may range from one-third to three times the volume of a *measured* drop or *minim*. It is manifest, therefore, that in dispensing medicines the measure should always be employed. When a more than ordinary degree of accuracy is required, the *Minim-Meter* is used.

Specific Gravity.—The specific gravity of a medicine is frequently one of its most important characters, and we may often determine the purity and strength of a medicine by this test alone. In the preparation of fluid medicines we are guided by their specific gravities in fixing the degree of dilution or concentration. For example, the specific gravity of well-prepared dilute nitro-hydrochloric acid is 1·074, and that of Syrup of Tolu is 1·330; and if they have any other specific gravity they are faulty. It is obviously important, therefore, that we should be able readily and accurately to apply this test. The specific gravity of a medicinal substance is its density as compared with that of an equal volume of pure distilled water at a temperature of 60° Fahr., if the substance be solid or liquid ; or, as compared with the density of an equal volume of atmospheric air of equal temperature, if the substance be gaseous. Different methods are pursued for testing the specific gravities of solid, liquid, and gaseous or vaporous substances: but for ordinary purposes the *Hydrometer* (*Areometer*, *Gravimeter*) is most useful, for it is of comparatively rare occurrence that we are called upon in practice to test the density of solids or gases. The *hydrometer* is an instrument used for ascertaining the specific gravities of liquids, and of this there are several varieties, differing in name and construction, according to the views of the inventors, or the purpose for which the instrument is destined. It receives the name of Alcohometer (for alcohol), Elæometer (for oils), Galactometer (for milk), Saccharometer (for syrups), Urinometer (for urine), &c. *Specific gravity beads* are hydrometers, and are used for similar purposes. The *specific gravity bottle* is also used; it is a bottle capable of holding a definite quantity of pure water at 60° Fahr. It is usually made to contain a thousand grains weight of water, and, when accurately filled with any other liquid, at the same temperature, its weight represents the specific gravity of that liquid. All the instruments now mentioned, equally with the ordinary weights and measures, are subject to imperfections, and none should be used that has not been specially tested. The volume and density of a liquid is altered by variations of temperature, and, therefore, the results given by testing the specific gravity would be erroneous, unless taken at the temperature at which the standard is fixed. Formerly, the temperature for taking specific gravities of medicines was 62° Fahr.; but in the British Pharmacopœia the operation is ordered to be conducted at 60° Fahr. When purchasing hydrometers it is important to know the temperature at which they were made, because if the specific gravity of a liquid be taken at a temperature differing from that at which the instrument was graduated, a certain correction must be made upon the result.

Weights and Measures of the British Pharmacopœia, with their Symbols.

WEIGHTS.

1 Grain,	gr.	. . .		=	1 grain.
1 Ounce (Avoir.),	oz.	. . .		=	437·5 grains.
1 Pound,	lb.	=	16 ounces	=	7000 grains.

Measures of Capacity.

1 Minim,	min.	=	1 minim,	min. j.
1 Fluid drachm,	fl. drm.	=	60 minims,	min. lx.
1 Fluid ounce,	fl. oz.	=	8 fluid drachms,	fl. drs. viij.
1 Pint,	O	=	20 fluid ounces,	fl. oz. xx.
1 Gallon,	C	=	8 pints,	Oviij.

Temperature in all cases is to be determined by Fahrenheit's thermometer; and the specific gravity of liquids is to be taken at the temperature of 60° (formerly 62°). All liquids are ordered by measure, unless it is stated otherwise.

Measures of Length.

1 Line	=	$\frac{1}{12}$ inch.
1 Inch	=	$\frac{1}{39 \cdot 1393}$ seconds pendulum.
12 Inches	=	1 foot.
36 „	=	3 feet = 1 yard.

Length of pendulum vibrating seconds of mean time in the latitude of London, in a vacuum at the level of the sea, ... } 39·1393 inches.

Relation of Measures to Weights of British Pharmacopœia.

1 Minim is the measure of			0·9114583	grains of water.
1 Fluid drachm	„		54·6875	„
1 Fluid ounce	„	1 ounce, or	437·5	„
1 Pint	„	1·25 lbs., or	8750·0	„
1 Gallon	„	10 lbs., or	70000·0	„

Weights and Measures of the Metric System.

1 Milligramme =	the thousandth part of 1 gramme, or		0·001	grm.
1 Centigramme =	the hundredth part	„	0·01	„
1 Decigramme =	the tenth part	„	0·1	„
1 Gramme =	{ weight of a cubic centimetre of water at 4° Centigrade, . }		1·0	„
1 Decagramme =	ten grammes, ...		10·0	„
1 Hectogramme =	one hundred grammes, .		100·0	„
1 Kilogramme =	one thousand grammes, .		1000·0	„

Measures of Capacity.

1 Millilitre =	1	Cubic Centimetre,	or the measure of	1	gramme of water.	
1 Centilitre =	10	„	„	10	„	
1 Decilitre =	100	„	„	100	„	
1 Litre =	1000	„	„	1000	„	(1 kilo.)

Measures of Length.

1 Millimetre =	the thousandth part of one metre, or		0·001	metre.
1 Centimetre =	the hundredth part	„	0·01	„
1 Decimetre =	the tenth part	„	0·1	„
1 Metre =			1·0	„

Relation of Weights of the British Pharmacopœia to Metric Weights.

1 Grain	=	0·0648 grammes.
1 Ounce	=	28·3495 „
1 Pound	=	453·5927 „

Relation of Measures of the British Pharmacopœia to Metric Measures.

1 Minim	=	0·000059 litres,	or 0·059	cubic centimetres.
1 Fluid drachm	=	0·003550 „	or 3·550	„
1 Fluid ounce	=	0·028397 „	or 28·397	„
1 Pint	=	0·567932 „	or 567·932	„
1 Gallon	=	4·543458 „		

Relation of the Metric Weights to the Weights of the British Pharmacopœia.

1 Milligramme	=	0·015432 grs.
1 Centigramme	=	0·15432 „
1 Decigramme	=	1·5432 „
1 Gramme	=	15·432 „
1 Kilogramme	= 2 lbs. 3 oz. 119·8 grs., or	15432·349 grs.

Relation of the Metric Measures to the Measures of the British Pharmacopœia.

1 Millimetre	=	0·03937 inches.
1 Centimetre	=	0·39371 „
1 Decimetre	=	3·93708 „
1 Metre	=	39·37079 „ or 1 yard 3·37 inches.
1 Cubic centimetre	=	15·432 grain measures.
1 Litre	=	1 pint 15 oz. 2 drs. 11 min., or 15432·348 grain measures.

Weights.—The weights of the British Pharmacopœia differ from those of any previous pharmacopœia. They consist of a combination of two systems, namely, the *avoirdupois* pound and ounce, with the *troy* grain. Formerly, troy, or apothecaries' weight, was exclusively used in pharmacy, and its relative proportions were as follows :—

1 Grain,	gr.	. . . . .	=	1 grain.
1 Ounce,	oz.	. . . . .	=	480 grains.
1 Pound,	lb.	= 12 ounces	=	5760 „

But the Dublin College of Physicians, in the last edition of its Pharmacopœia, set aside the old troy weight, by adopting in its stead the imperial or avoirdupois weights for the ounce and higher denominations,—a departure from long established usage which appeared to the Medical Council judicious and worthy of imitation. Formerly there were two other denominations of weights between the ounce and the grain, namely, the *drachm*, equal to 60 grains, and the *scruple*, equal to 20 grains, but these have been abandoned by the Medical Council for the following reasons :—In troy or apothecaries' weight, the drachm and the scruple are both multiples of the grain, and integral parts of the higher denominations of weights, the ounce and the pound. But the troy grain will not adapt itself both to the old drachm and scruple and to the avoirdupois ounce and pound. If 60 grains were held to represent the drachm, then eight drachms would no longer represent the ounce, for $8 \times 60 = 480$ grains, which is the troy ounce; whereas the avoirdupois ounce, now used, equals only 437·5 grains. In like manner, if the drachm were 60 grains, then 128×60 (*i.e.*, the number of drachms in sixteen ounces multiplied by the number of grains in a drachm) would give 7680 grains to the pound, whereas the present pound is only equal to 7000 grains: and so also with the scruples. If they would have preserved the drachm and the scruple, the Medical Council would have had either to alter the relative value of these weights, as the Dublin College did,—making the drachm to equal 54·68 grains, and the scruple to equal 18·22,—or to substitute a new medical grain for the troy grain, hitherto the medical as well as the standard grain of the kingdom. But in deference to the general feeling of the medical profession, in the second edition of the British Pharmacopœia, the Medical Council so far relaxed the stringency of their proscription of the use of the lower denominations, drachm and scruple, as to leave it optional with the physician to use in prescribing, if he considered it more convenient, the symbols (ʒ) and (℈), instead of 60 grains and 20 grains respectively. They recommend, however, that drachm (or ʒ) shall in all cases mean 60 grains troy, and never the eighth part of the avoirdupois ounce; and that scruple (or ℈) shall in like manner mean 20 grains troy, and never the twenty-fourth part of the ounce.

MEASURES.—The measures of the British Pharmacopœia remain unchanged. It was considered impossible to improve the system which has become so familiar.

SYMBOLS.—The following changes have been made in the symbols of the weights and measures:—oz. instead of ℥; fl. oz. instead of f℥; fl. dr. instead of fʒ; min. instead of ♏; and lb. (avoirdupois) instead of lb. (troy), the bar across the letters being omitted. The numbers representing the quantity of solid ingredients are Arabic, those representing the quantity of fluids are Roman numerals.

OFFICIAL FORMULÆ.

Prescription has a wider signification than *Formula*, for it includes general directions as to the treatment of the patient, not only by medicine, but also by diet, clothing, exercise, ventilation, &c.

Formula (diminutive of Forma, *a form, scheme, rule, recipe*) is restricted to the directions given in writing for the preparation and application of medicinal remedies. A *simple formula* consists of one medicinal preparation, either simple or compound. A *compound formula* consists of two or more. A formula constructed *extemporaneously* by the physician is called *magistral, i.e.*, written by a *master* of his profession to meet the indications of the case he is called upon to prescribe for. *Official* medicines are properly *shop*-medicines, because kept ready for use in shops (*officina*); but we confine the term to those prepared according to the formulæ of the British Pharmacopœia: therefore, a medicine that is "not official" is to be understood as not having the sanction of the Pharmacopœia. The individual formulæ for the preparation of official remedies will be given hereafter, under the name of each of the chief ingredients; but there are certain groups of formulæ for what are indefinitely termed *Galenical Preparations*, which it will be serviceable at once to pass in review. They are the following:—

Aquæ.—There are nineteen formulæ for *Distilled Waters* in the British Pharmacopœia, thirteen of which are prepared from the vegetable kingdom, the fourteenth being distilled water and the other five are *Aqua Chloroformi, Calcis, Lithiæ Effervescens, Potassæ Effervescens, Sodæ Effervescens.* Twelve of the "waters" are rendered medicinal by distilling them with certain vegetable substances, whilst another is simply *Spring water* rendered tasteless and inodorous, and deprived as much as possible of impurities, by distillation. The volatile principles separated and retained by the distilled waters are either abstracted from some part of the solid substance of the plant, as in *Aqua, Anethi, Anisi, Carui, Cinnamomi, Fœniculi, Lauro-cerasi, Pimentæ, Rosæ et Sambuci;* or from the volatile oils previously obtained from the plants, as in *Aqua Menthæ Piperitæ et Aqua Menthæ Viridis, Aurantii Flori. Aqua* (formerly *Mistura*) *Camphoræ* is an exception to the rule; it is prepared by simply keeping the camphor immersed in distilled water; and Aqua Chloroformi, which is chloroform dissolved in distilled water.

Distilled Waters are chiefly used as vehicles for other medicines; but some of them are given to children alone, in doses of *fl. dr.* i-ii, and to adults in doses of *fl. oz.* ss-j. *Aqua Lauro-cerasi* is a very uncertain preparation as to its strength, and is never given to children, and to adults in doses not exceeding *min.* x. to *fl. dr.* i. *Aqua Rosæ* is chiefly used as an elegant vehicle for lotions and collyria. The distilled waters formerly contained spirit to preserve them; but far from this, it spoiled them by undergoing the acetous fermentation (WARRINGTON).

AQUA.

		Water.	Distil.
Anethi.	Dill, *lb.* 1.	C 2	C 1
Anisi.	Anise, *lb.* 1	C 2	C 1
Aurantii Floris.	Bitter orange flower. . . .		
Camphoræ (*Mistura*).	Camphor, *oz.* ½. . . (distilled)	C 1	
Carui.	Caraway, *lb.* 1.	C 2	C 1
Cinnamomi.	Cinnamon, *oz.* 20.	C 2	C 1
Destillata.	Water, free from taste and odour. .	C 10	C 8
Fœniculi.	Sweet fennel fruit, *lb.* 1. . .	C 2	C 1
Lauro-cerasi.	Fresh leaves of common laurel, *lb.* 1.	O 2½	O 1
Menthæ Piperitæ.	Oil of peppermint. *fl. dr.* 1½. . .	C 1½	C 1
Menthæ Viridis.	Oil of spearmint, *fl. dr.* 1½. . .	C 1½	C 1
Pimentæ.	Pimento, *oz.* 14.	C 2	C 1
Rosæ.	Fresh petals of Rosa centifolia, *lb.* 10.	C 2	C 1
Sambuci.	Fresh Elder flowers, free from stalks, *lb.* 10.	C 2	C 1

Cataplasmata.—There are six formulæ for *Poultices* in the British Pharmacopœia. Poultices consist of—the *liquor* or fluid part; the *corpus*, or substance of the poultice; and the *accessorium*, or active medicinal ingredient. Of the official cataplasms, the *liquor* is boiling water (with one exception, *C. Fermenti*); the *corpus* is linseed meal, bread, or flour; and the *accessorium* is charcoal, hemlock leaf, beer yeast, mustard, or chlorinated soda. Water at a higher temperature than 100° would interfere with the catalytic process in C. Fermenti. *Magistral* cataplasms may include many other ingredients, whether liquid or solid. When an active medicinal substance is added, it must be incorporated with the *liquor* and *corpus* of the poultice at such a temperature that, if fugitive, it be not driven off; and in such a manner as to approach near to the part to which the poultice is applied, for a remedial agent buried in the depths of a thick tenacious poultice would be of little service. The *liquor* may consist of a decoction of a medicinal plant. Cataplasms, though easily made, demand both knowledge and care; for, as Dr Paris said, "Science does not withhold her aid even on the humble occasion of making a poultice." The temperature and tenacity of the poultice are important points: it should have a medium consistency, neither too dry nor too soft, and should be able to supply a sufficiency of moisture, without scattering its *liquor* to the discomfort of the patient. Poultices are employed chiefly to supply warmth and moisture; they are sometimes applied cold, more frequently tepid, and sometimes as hot as the patient can bear them, and are used according to circumstances, as *emollients*, *stimulants*, or *counter-irritants* (sinapisms), *sedatives*, *antiseptics*, *refrigerants*, &c.

When the part is to be softened and lubricated, fatty substances are added. *Spongio-piline* is sometimes used as an elegant substitute for a cataplasm when heat and moisture alone are required.

CATAPLASMA.

Carbonis.	Wool charcoal, *oz.* ½; bread, *oz.* 2; linseed meal, *oz.* 1½; boiling water, *fl. oz.* 10.
Conii.	Hemlock juice, *oz.* 1; linseed meal, *oz.* 4; boiling water, *fl. oz.* 10.
Fermenti.	Beer yeast, *fl. oz.* 6; flour, *oz.* 14; water at 100° F. (37°·8 C.), *fl. oz.* 6.
Lini.	Linseed meal, *oz.* 4; boiling water, *fl. oz.* 10.
Sinapis.	Mustard, *oz.* 2½; linseed meal, *oz.* 2½; boiling water; water, of each a sufficiency.
Sodæ Chlorinatæ.	Solution of chlorinated soda, *fl. oz.* 2; linseed meal, *oz.* 4; boiling water, *fl. oz.* 8.

Confections.—There are eight formulæ for *Confections* in the British Pharmacopœia. The terms *Electuarium* and *Conserva* are abolished. Confections serve two chief purposes; they are useful as excipients for medicines that are given in large quantities, such as powders, which, being almost insoluble, cannot be given agreeably in the form of mixture; and they serve also to give a proper consistency to pill masses. The solid substances of the confection are formed into a softish pasty mass by means of honey, syrup, mucilage, &c. Those made with mucilage soon become hard, and syrup is apt to crystallise, unless certain precautions be used. These medicines are of ancient date, and formerly consisted of most chaotic masses, but they are now comparatively seldom used. Several of the confections of older pharmacopœias are no longer official, and two have changed their names and conditions, namely, the old *Confectio Amygdalæ, Conserva Amygdalarum*, which is now a dry preparation under the name of *Pulvis Amygdalæ Compositus;* and the old *Confectio Aromatica* (P.L.), which is now represented with some changes by *Pulvis Cretæ Aromaticus.*

CONFECTIO.

Opii.	Compound powder of opium, *gr.* 100; syrup, *gr.* 300.
Piperis.	Black pepper, *oz.* 2; caraway, *oz.* 3; clarified honey, *oz.* 15.
Rosæ Caninæ.	Hips, deprived of seeds, *lb.* 1; refined sugar, *lb.* 2.
Rosæ Gallicæ.	Fresh red-rose petals, *lb.* 1; refined sugar, *lb.* 3.
Scammonii.	Resin of Scammony, *oz.* 6; ginger, *oz.* 3; oil of caraway, *oz.* ¼; oil of cloves, *oz.* ⅛; syrup, *oz.* 6; clarified honey, *oz.* 3.

Sennæ.	Senna, *oz.* 7 ; coriander, *oz.* 3 ; figs, *oz.* 12 ; tamarinds, *oz.* 9 ; cassia pulp, *oz.* 9 ; prunes, *oz.* 6 ; extract of liquorice, *oz.* 1 ; refined sugar, *oz.* 30 ; distilled water, a sufficiency to make the result weigh *oz.* 75.
Sulphuris.	Sublimed sulphur, *oz.* 4 ; acid tartrate of potash, *oz.* 1 ; syrup of orange peel, *fl. oz.* 4 ; tragacanth, *gr.* 18.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1 ; liquorice root, *oz.* 1 ; clarified honey, *oz.* 2.

Decocta.—There are thirteen formulæ for *Decoctions* in the British Pharmocopœia. They are all made by boiling vegetable substances in water, the object of the process being to obtain principles which cannot be separated at a lower temperature. Vegetables containing fugitive principles, or such as are injured by a high temperature, cannot be used as decoctions. The time prescribed for boiling the official decoctions is from five to twenty minutes, except *D. Granati Radicis*, which is boiled from two pints to one ; and they are to be strained immediately after the boiling, except in the cases of *D. Cinchonæ*, *D. Aloes Comp.*, *D. Sarsæ*, and *D. Sarsæ Comp.*, the first being strained when *cold*, the rest when *cool*. All the formulæ for the official decoctions are *simple*, except *D. Aloes Co.*, and *D. Sarsæ Co.* Decoctions are prone to change, and therefore should be made only when required, or if prepared in anticipation, should be frequently renewed.

	Decoctum.	Dist. Water.	Minutes, to Boil.	Prodt.
Aloes Compositum.	Extract of socotrine aloes, *oz.* ½. Myrrh, saffron, of each, *oz.* ¼. Carbonate of potassium, *oz.* ¼. Extract of liquorice, *oz.* 2. Comp. tinct. of cardamoms, *fl. oz.* 15. Distilled water, a sufficiency to make 50 *fl. oz.*	*Q.S.*	5	*oz.* 50
Cetrariæ.	Iceland moss, *oz.* 1. . . .	O 1	10	O 1
Cinchonæ.	Red cinchona bark, *oz.* 1¼. .	O 1	10	O 1
Granati Radicis.	Pomegranate root, fresh or dry, *oz.* 2.	O 2	boil to	O 1
Hæmatoxyli.	Logwood chips, *oz.* 1 ; cinnamon, *gr.* 55. . . .	O 1	10	O 1
Hordei.	Pearl barley, *oz.* 2.	O 1½	20	
Papaveris.	Poppy capsules, without seeds, *oz.* 2.	O 1½	10	O 1
Pareiræ.	Pareira, *oz.* 1¼. . . .	O 1	15	O 1
Quercus.	Oak bark, *oz.* 1¼.	O 1	10	O 1
Sarsæ.	Jamaica sarsaparilla, cut transversely, *oz.* 2½. . . .	O 1½	10	O 1

		Dist. Water.	Minutes, to Boil.	Prodt.
Sarsæ Compositum.	Jamaica sarsaparilla, cut transversely, *oz.* 2½. Sassafras chips, *oz.* ¼. Guaiac wood turnings, *oz.* ¼. Dried liquorice root, *oz.* ¼. Mezereon, *gr.* 60.	O 1½	10	O 1
Scoparii.	Dried broom tops, *oz.* 1.	. O 1	10	O 1
Taraxaci.	Dried dandelion root, *oz.* 1.	. O 1	10	O 1

Emplastra.—There are fourteen formulæ for *Plasters* in the British Pharmacopœia. Several of the old plasters are omitted, but there are no additions, except that *Ceratum Saponis Compositum* of the London Pharmacopœia is introduced under the name of *Emplastrum Cerati Saponis,* and now its name is changed to *Emplastrum Sapons Fuscum.* All true plasters have for their basis *litharge,* in combination with *Oleic, Margaric,* and *Stearic* acids. Eight of the official plasters are so prepared. The rest are not strictly plasters, although so called; they owe their consistency either to wax, suet, resin, and lard,. as in *Emp. Cantharidis;* to pitch, frankincense, resin, wax, &c., as in *Emp. Picis;* or to the chemical action of the ingredients upon one another, as in *Emp. Ammoniaci cum Hydrargyro.* Plasters are used externally, and adhere more or less firmly to the surface of the body, according to the amount of resin present; but as this is an irritating ingredient, its quantity should be modified, according to the sensitiveness of the skin and other circumstances. Changes may be made upon the official plasters; other ingredients may be added or quantities modified; but commonly one or other of the official forms is prescribed. They are kept in rolls, and are spread to the required size upon leather, cloth, calico, linen, silk, or other fabric (but chiefly leather), to suit the occasion, care being taken not to injure them by melting at a needlessly high temperature. Plasters are used to give mechanical support, and also as a mode of the external application of medicines, and are to be selected accordingly *Emplast. Cantharidis* is vulgarly called "*a blister,*" or "*a rising blister.*"

EMPLASTRUM.

Ammoniaci cum Hydrargyro.	Ammoniac, *oz.* 12; mercury, *oz.* 3; olive oil, *gr.* 56; sulphur, *gr.* 8.
Belladonnæ.	Alcoholic extract of belladonna, *oz.* 4; resin plaster, *oz.* 8; soap plaster, *oz.* 8.
Calefaciens.	Cantharides, *oz.* 4; expressed oil of nutmeg, *oz.* 4; yellow wax, *oz.* 4; resin, *oz.* 4; soap plaster, *lb.* 2; resin plaster, *lb.* 3¼; boiling water, *O* 1.

Cantharidis.	Cantharides, *oz.* 12; yellow wax, *oz.* $7\frac{1}{2}$; prepared suet, *oz.* $7\frac{1}{2}$; resin, *oz.* 3; prepared lard, *oz.* 6.
Saponis Fuseum.	Curd soap, *oz.* 10; yellow wax, *oz.* $12\frac{1}{2}$; olive oil, *O* 1; oxide of lead, *oz.* 15; vinegar, *C* 1.
Ferri.	Peroxide of iron, *oz.* 1; Burgundy pitch, *oz.* 2; lead plaster, *oz.* 8.
Galbani.	Galbanum, *oz.* 1; ammoniac, *oz.* 1; yellow wax, *oz.* 1; lead plaster, *oz.* 8.
Hydrargyri.	Mercury, *oz.* 3; olive oil, *gr.* 56; sublimed sulphur, *gr.* 8; lead plaster, *oz.* 6.
Opii.	Finely powdered opium, *oz.* 1; resin plaster, *oz.* 9.
Picis.	Burgundy pitch, *oz.* 26; common frankincense, *oz.* 13; resin, *oz.* $4\frac{1}{2}$; yellow wax, *oz.* $4\frac{1}{2}$; expressed oil of nutmeg, *oz.* 1; olive oil, *fl. oz.* 2; water, *fl. oz.* 2.
Plumbi.	Oxide of lead, *lb.* 5; olive oil, *lb.* 10; water, *lb.* 5.
Plumbi Iodidi.	Iodide of lead, *oz.* 2; resin, *oz.* 2; lead plaster, *lb.* 1.
Resinæ.	Resin, *oz.* 4; lead plaster, *lb.* 2; curd soap, *oz.* 2.
Saponis.	Curd Soap, *oz.* 6; lead plaster, *lb.* $2\frac{1}{4}$; resin, *oz.* 1.

Enemata.—There are five formulæ for *Enemata* in the British Pharmacopœia. A great variety of *Magistral* formulæ for enemata are constructed to suit special circumstances. We shall revert to this subject when treating of the channels by which medicines are introduced into the system.

ENEMA.

Aloes.	Aloes, *gr.* 40; carbonate of potash, gr. 15; mucilage of starch, *fl. oz.* 10.
Assafœtidæ (*Fœtidum*).	Assafœtida, *gr.* 30; distilled water, *fl. oz.* 4.
Magnesii Sulphatis (*Catharticum*).	Sulphate of magnesium, *oz.* 1; olive oil, *fl. oz.* 1; mucilage of starch, *fl. oz.* 15.
Opii.	Tinct. of opium, *fl. dr.* $\frac{1}{2}$; mucilage of starch, *fl. oz.* 2.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1; mucilage of starch, *fl. oz.* 15.

Essentiæ.—Essences, as distinguished from spirits, are strong solutions of volatile oils. Two are introduced in the Britsh Pharmacopœia, and they each contain one part of the volatile oil to four of rectified spirit.

ESSENTIA.

Anisi.	Oil of anise, *fl. oz.* 1; rectified spirit, *fl. oz.* 4.
Menthæ Pipritæ.	Oil of peppermint, *fl. oz.* 1; rectified spirit, *fl. oz.* 4.

Extracta.—There are forty-seven formulæ for *Extracts* in the British Pharmacopœia. Many of the old extracts are omitted, and several new ones added. Among the latter is a new order of "liquid" extracts. *Extractum Cinchonæ Liquidum* is very nearly the same as the old *Infusum Cinchonæ Spissatum*, and the *Extractum Filicis Liquidum* was formerly called *Oleum Filicis-Maris.* Extracts, when carefully prepared, are an exceedingly useful class of remedies ; but, unfortunately, they are often spoiled in the making, and are then worse than useless. We shall briefly examine the process of the preparation in three stages. 1. The substances from which they are prepared, and the preliminary steps taken with them. 2. The separation of the active principles. 3. The evaporation.

1. Extracts are derived from different parts of plants, *e.g.*, fresh leaves, flowering tops, young branches, flowers, roots, barks, corms, woods, resins, &c. ; and these are subjected to some preliminary operations, such as bruising, crushing, coarsely and finely powdering, slicing, &c.

2. The active principles are separated by various means, such as —by simply squeezing out the juice—*fresh* or *green extracts ;* by cold or boiling distilled water—*aqueous extracts ;* by rectified, proof, or more diluted spirit—*alcoholic extracts ;* by ether, *ethereal extracts ;* by acetic acid—*acetic extract.* In the preparation of *fresh* or *green* extracts the juice of the plant is pressed out and at once evaporated. The solutions from which the *aqueous* extracts are made are prepared either by *decoction, infusion,* or *digestion in boiling water*, or by *maceration in cold water*, and are recovered either by means of the press or displacement. *Alcoholic* extracts are prepared by macerating the substances in the spirit for a fixed time, recovering the solution by pressure or percolation, and removing the spirit by distillation. In the preparation of *Ext. Ergotæ Liquidum*, the ergot is first percolated with ether to remove its oil, and afterwards it is prepared as an aqueous extract. *Extractum Filicis Liquidum* is percolated with ether (which is either removed by the water-bath or recovered by distillation) to procure at once the oily extract.

3. It is only now, when the active principles have been extracted from the vegetable substances and are held in solution, that the difficulty and danger begin. The next step is to bring them to the state of extracts without injuring them. The chief risks to which they are exposed in this part of the process are excessive heat and atmospheric influences. Evaporation may be conducted—(1) spontaneously ; (2) over a naked fire ; (3) in a water-bath or steam-bath ; (4) *in vacuo.* The plan to be adopted will depend upon the nature of the ingredients, the more common method being by the water-bath or steam-bath. When a very low temperature is desirable, the pressure of the atmosphere is removed, the evaporation being conducted *in vacuo.* The lower the temperature the better, provided it be sufficient to conduct the process with promptness, but a linger-

ing process leads to injurious chemical changes. Two things are essential to the *preservation* of extracts—*coolness* and *dryness*; a high temperature promotes fermentation; a damp atmosphere causes mouldiness. The *green colour* of fresh extracts is sometimes urged as a proof of the excellence of the preparation, but it is no proof at all, seeing that the green colouring matter is carefully nursed, whilst the active part of the extract is undergoing the critical process of evaporation.

Liquid or *fluid* extracts have been gradually coming into use for several years, and are found to be very suitable preparations for many medicines. They are eleven in number, but two of them, under other names, were previously official. The liquid extracts of *Bael*, *Ergot*, and *Pareira* are made in such a way that each fluid part represents an equal part of the drug employed, a fluid ounce of the preparation being equal to a solid ounce of the vegetable. Extracts contain the medicinal constituents of plants reduced to a minimum bulk, and, when carefully prepared, are very useful, for they generally create less objection on the part of patient than any other form of medicine. They are given either alone, or in combination with other medicines, either in the form of a pill, or (the aqueous variety) dissolved in mixture. The initials in the following list signify:—*a.* extracts prepared from the fresh juice (*fresh* or *green*); *b. aqueous extracts; bb. alcoholic extracts; c. liquid extracts; cc. liquid extracts* prepared more or less by ether; *aa. fresh* or *green extracts,* but the process is a little different.

EXTRACTUM.

a. Aconiti.	Fresh leaves and flowering tops of aconite, *lb.* 112.
b. Aloes Barbadensis.	Barbadoes aloes, *lb.* 1; boiling dist. water, *C* 1.
b. Aloes Socotrinæ.	Socotrine aloes, *lb.* 1; boiling dist. water, *C* 1.
b. Anthemidis.	Chamomile flowers, *lb.* 1; oil of chamomile, *min.* 15; distilled water, *C* 1.
c. Belæ Liquidum.	Bael, *lb.* 1; distilled water, *O* 12; rectified spirit, *fl. oz.* 3.
a. Belladonnæ.	Fresh leaves and young branches of Belladonna *lb.* 112.
bb. Belladonnæ Alcoholium.	Belladonna root, *lb.* 1; rectified spirit and distilled water, of each a sufficiency.
bb. Calumbæ.	Calumba, *lb.* 1; distilled water, *O* 4.
bb. Cannabis Indicæ.	Indian hemp, *lb.* 1; rectified spirit. *O* 4.
Cascaræ Sagradæ.	Cascara, *lb.* 1; proof spirit and distilled water, of each a sufficiency.
c. Cascaræ Sagradæ Liquidum.	Cascara, *lb.* 1; rectified spirit, *oz.* 4; distilled water, a sufficiency.
c. Cinchonæ Liquidum.	Red cinchona bark, *oz.* 20; hydrochloric acid, *fl. dr.* 5; glycerine, *oz.* $2\frac{1}{2}$; rectified spirit and distilled water, of each a sufficiency.

aa. Colchici.	Fresh colchicum corms, deprived of their coats, *lb.* 7.
aa. Colchici Aceticum.	Fresh colchicum corms, deprived of their coats, *lb.* 7 ; acetic acid, *fl. oz.* 6.
bb. Colocynthidis Compositum.	Colocynth, freed from seed, *oz.* 6 ; extract of socotrine aloes, *oz.* 12 ; resin of scammony, *oz.* 4 ; curd soap, *oz.* 3 ; cardamoms, in fine powder, *oz.* 1 ; proof spirit, *C* 1.
a. Conii.	Fresh leaves and young branches of hemlock, *lb.* 112.
c. Cimicefugæ Liquidum.	Cimicefugæ, *oz.* 20; rectified spirit, a sufficiency.
c. Cocæ Liquidum.	Coca, *oz.* 20 ; proof spirit, a sufficiency.
c. Ergotæ Liquidum.	Ergot, *lb.* 1 ; distilled water, *O* 6 ; rectified spirit, *fl. oz.* 6.
cc. Filicis Liquidum.	Fern root, *lb.* 2 ; ether, *O* 4 or *Q.S.*
b. Gentianæ.	Gentian, *lb.* 1; boiling distilled water, *C* 1.
b. Glycyrrhizæ.	Liquorice root, *lb.* 1 ; distilled water, *O* 4.
Glycyrrhizæ Liquidum.	Liquorice root, *lb.* 1 ; distilled water, *O* 4 ; rectified spirit, a sufficiency.
bb. Gelsemii Alcoholicum.	Gelsemium, *lb.* 1 ; rectified spirit and distilled water, a sufficiency.
b. Hæmatoxyli.	Logwood chips, *lb.* 1 ; boiling dist. water, *C* 1.
a. Hyoscyami.	Fresh leaves and young branches of hyoscyamus, *lb.* 112.
bb. Jalapæ.	Jalap, *lb.* 1 ; rect. spirit, *O* 4 ; dist. water, *C* 1.
bb. Jaborandi.	Jaborandi, *lb.* 1; of proof spirit and distilled water, *Q.S.*
b. Krameriæ.	Rhatany, *lb.* 1 ; distilled water, *Q.S.*
a. Lactucæ.	The flowering herb of lettuce, *lb.* 112.
bb. Lupuli.	Hop, *lb.* 1 ; rect. spirit, *O* 1½ ; dist. water, *C* 1.
cc. Mezerei Æthereum.	Mezereon cut small, *lb.* 1 ; rectified spirit, *O* 8 ; ether, *O* 1.
bb. Nucis Vomicæ.	Nux vomica, *lb.* 1 ; rectified spirit, *fl. oz.* 64 ; distilled water, *fl. oz.* 16.
b. Opii.	Thinly sliced opium, *lb.* 1 ; distilled water, *O.* 6.
c. Opii Liquidum.	Extract of opium, *oz.* 1 ; distilled water, *fl. oz.* 16 ; rectified spirit, *fl. oz.* 4.
bb. Papaveris.	Poppy capsules, dried, freed from seeds, and coarsely powered, *lb.* 1 ; rectified spirit, *fl. oz.* 2 ; distilled water, *Q.S.*
b. Pareiræ.	Pareira root in coarse powder, *lb.* 1 ; boiling distilled water, *C* 1 or a sufficiency.
c. Pareiræ Liquidum.	Extract of pareira, distilled water, rectified spirit, of each *Q.S.*
bb. Physostigmatis.	Calabar bean in coarse powder, *lb.* 1 ; rectified spirit, *O* 4.
b. Quassiæ.	Quassia wood, rasped, *lb.* 1 ; dist. water, *Q.S.*
bb. Rhamni Frangulæ.	Rhamnus Frangula, bark, *lb.* 1; proof spirit and distilled water, *Q.S.*

c. Rhamni Frangulæ Liquidum.	Rhamnus Frangula, bark, *lb.* 1; rectified spirit, *oz.* 4; distilled water, *Q S.*
bb. Rhei.	Rhubarb, *lb.* 1; rect. sp., dist. water, *Q.S.*
c. Sarsæ Liquidum.	Jamaica sarsaparilla, *oz.* 40; proof spirit, *O* 2; sugar, *oz.* 5; distilled water, *O* 12.
bb. Stramonii.	Stramonium seeds, *lb.* 1; ether, *O* 1 or *Q.S.;* proof spirit and distilled water, of each *Q.S.*
aa. Taraxaci.	Fresh dandelion root, *lb.* 4.
b. Taraxaci Liquidum.	Dry dandelion root, *oz.* 40; proof spirit, *O* 4; distilled water, *Q.S.*

Glycerina.—This is a class of preparations made official for the first time in the second edition of the British Pharmacopœia. They are eight in number, and form elegant vehicles for the application and administration of the active principles dissolved in the glycerine. In their formation the excellent solvent and antiseptic properties of glycerine are utilised. Glycerinum amyli was introduced a few years ago by Mr Schacht of Clifton, under the name of "plasma," as a fit substitute to replace the oily bases of ointments and other preparations. It is specially worthy of attention, as it has no tendency to become rancid, and is thus better suited than ordinary ointment to preserve any active principle liable to decomposition, while it is, at the same time, more agreeable and cleanly.

GLYCERINUM.

Acidi Carbolici.	Carbolic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Acidi Gallici.	Gallic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Acidi Tannici.	Tannic acid, *oz.* 1; glycerine, *fl. oz.* 4.
Aluminis.	Alum, *oz.* 1; glycerine, *fl. oz.* 5.
Amyli.	Starch, *oz.* 1; glycerine, *fl. oz.* 8; dist. water, *oz.* 3.
Boracis.	Borax in powder, *oz.* 1; glycerine, *fl. oz.* 4; distilled water, *oz.* 2.
Plumbi Subacetatis.	Acetate of lead, *oz.* 5; oxide of lead, *oz.* $3\frac{1}{2}$; glycerine, 1 *pint*; distilled water, *oz.* 12.
Tragacanthæ.	Tragacanth, *grs.* 110; glycerine, *oz.* 1; distilled water, *fl. gr.* 74.

Infusa.—There are twenty-eight formulæ for *Infusions* in the British Pharmacopœia. Infusions are prepared by pouring water upon vegetable substances, and allowing the latter to remain in the liquid for a certain length of time, varying according to circumstances. Infusions are preferred to decoctions when the substances to be operated upon are less dense, and when the desired principles can be abstracted at a temperature below the boiling point; also when we wish to preserve certain fugitive principles which impart an agreeable aroma, besides being otherwise valuable, and which would be driven off by boiling. The vegetable substances usually undergo some preliminary mechanical operation to render them more permeable ; they are either *bruised, cut small, sliced, chipped,* or *coarsely powdered.* The temperature of the water is in twenty-four cases at the boiling point (212° Fahr.) ; in two instances at 120° Fahr. ; and in two *cold.* The water is used either cold or below the boiling point, when that of a higher temperature would abstract noxious principles, as in the case of *Inf. Calumbæ.* The time prescribed for infusion varies from ten minutes to two hours, according to the facility with which the desired principles are abstracted. Infusions are to be strained so soon as the prescribed time is past, but they are often injured from carelessness in leaving the vegetable substances indefinitely in the liquid. *Inf. Cusso* is an exception, it is not strained at all ; the solids and fluids are swallowed together. Infusions are prone to change, and should therefore be frequently renewed. "Infusion of senna, which would change in twelve hours in hot weather, will keep for several days perfectly good if one grain of nitre be dissolved in each ounce of the infusion" (SQUIRE).

In the preparation of ordinary infusions, no common plan can be adopted so as to make them keep. In consequence, considerable objection is urged against them in the present form. Those of Senega, Senna, Calumba, Cascarilla, &c., being so liable to decompose, as to render an ordinary 6 oz. or 8 oz. mixture of them oftentimes useless before it has been finished. It has been recommended to preserve them by filling into various-sized bottles, placing these in a pan of water on the fire, and allowing the water to boil round them for ten minutes or so, then speedily tying a piece of moistened bladder over each bottle (Mr STEPHENSON). This is a modification of the method previously recommended by Mr Alsop, who closed the bottles with well-ground and slightly-conical stoppers, smeared with wax. The object in both cases is to exclude air from the bottles. Treated in this way, they are said to keep good for months ; but as so much depends on the season in which they are thus prepared, as well as on the kind of infusion, this method cannot be fully relied on. When ordinary infusions must be had, they should be prepared fresh, and, in warm weather especially, should be combined with some strong aromatic, and ordered in small quantities. To meet these difficulties, concentrated infusions have been introduced ; but from the indifferent manner in which they are frequently prepared they sometimes fail to give entire satisfaction. If Pharmaceutists, however, would individually turn their attention to this important class of preparations, instead of buying them ready made, concentrated infusions would be found to possess advantages the others could not claim. In the case of

Calumba, Senega, Senna, and Cascarilla, they should be prepared in *cold* weather. The mode of preparation is simple and easily accomplished. The article to be infused should be bruised or roughly powdered, and the quantity used should be *eight times* that required to prepare the ordinary infusion. Let the mass be well moistened with cold water, and, after standing for three hours, pack closely in a convenient percolator. Add now 15 oz. of cold water for each pint intended to be made. To make one pint, the exact method of procedure would then be as follows :—Draw off half a pint of the concentrated infusion, and transfer this to a separate bottle. Continue to add water to the residue till the whole strength of the substance has been exhausted. Reduce this in a water-bath evaporator to the bulk of 5 oz., mix it with the 10 oz. of infusion originally obtained, and with the addition of 5 oz. of rectified spirit make 20 oz. of infusión ; shake the whole, set aside for a few days, and filter. The process should be completed as rapidly as possible, in order to secure a first-rate preparation. The proportion of 1 part of such a prepartion added to 7 of water forms an infusion of the ordinary strength (Mr JAMES MACKENZIE). Infusions are chiefly used as vehicles for more active ingredients. They should be selected with the view of promoting the action of the combined medicines, or else of correcting their untoward effects. Some of them are given in a simple form, as *Inf. Cusso* and *Inf. Ergotæ.*

	Infusum.	Distilled Water. Quantity.	Temp.	Minutes Infused.
Anthemidis.	Chamomile flowers, *oz.* ¼.	*fl. oz.* 10	212°	15
Aurantii.	Bitter orange peel, *oz.* ½.	,,	,,	15
Aurantii Compositum.	Bitter orange peel, cut small, *oz.* ¼; fresh lemon peel, cut small, *gr.* 56 ; cloves, bruised, *gr.* 28. .	,,	,,	15
Buchu.	Buchu, *oz.* ½. . . .	,,	,,	60
Calumbæ.	Calumba, *oz.* ½. . .	,,	cold.	60
Caryophylli.	Cloves, *oz.* ¼. . . .	,,	212°	30
Cascarillæ.	Cascarilla, *oz.* 1. . .	,,	,,	60
Catechu.	Catechu, *gr.* 160. Cinnamon, *gr.* 30. .	,,	,,	30
Chiratæ.	Chiretta, *oz.* ¼. . .	,,	120°	30
Cinchonæ Acidum.	Red cinchona bark, *oz* ½. Aromatic sulphuric acid, *dr.* 1.	,,	212°	120
Cuspariæ.	Cusparia, *oz.* ½. . .	,,	213°	120
Cusso.	Kousso, *oz.* ½. . .	*fl. oz.* 8.	212° (not strained)	15
Digitalis.	Dried digitalis, *gr.* 28. .	*fl. oz.* 10	212°	60
Ergotæ.	Ergot, *oz.* ¼. . . .	,,	,,	30

		Distilled Water. Quantity	Temp.	Minutes. Infused.
Gentianæ Compositum.	Gentian root and bitter orange peel, of each *gr.* 55; fresh lemon peel, *oz.* ¼.	*fl. oz.* 10	212°	60
Jaborandi.	Jaborandi, *oz.* ½.	"	"	30
Krameriæ.	Rhatany, *oz.* ½.	"	"	60
Lini.	Linseed, *gr.* 150. Dried liquorice root, *gr.* 50.	"	"	240
Lupuli.	Hops, *oz.* ½.	"	"	120
Maticæ.	Matico, *oz.* ½.	"	"	30
Quassiæ.	Quassia chips, *gr.* 55.	"	cold.	30
Rhei.	Rhubarb, *oz.* ¼.	"	212°	60
Rosæ Acidum.	Red-rose petals, *oz.* ¼. Dilute sulph. acid, *fl. dr.* 1.	"	"	30
Senegæ.	Senega, *oz.* ½.	"	"	60
Sennæ.	Senna, *oz.* 1; ginger, *gr.* 28.	"	"	60
Serpentaræ.	Serpentary, *oz.* ¼.	"	"	120
Uvæ Ursi.	Bearberry leaves, *oz.* ½.	"	"	120
Valerianæ.	Valerian, *oz.* ¼.	"	"	60

Linimenta.—There are sixteen formulæ for *Liniments* in the British Pharmacopœia. Formerly some of the *tinctures* were made of extra strength for external application; but all such are now classed with the liniments, and therefore all tinctures are for internal use. True *liniments* (or *embrocations*) are of oily or saponaceous consistency, suitable, as the name applies, to *anoint* or *besmear* the part to which they are applied. Several of the official liniments, however, have not this character; such as *Lin. Iodi*, which has no oleaginous constituent, and *Lin. Aconiti* and *Lin. Belladonnæ*, which have only their camphor to represent the oleaginous ingredient. These, therefore, are not suitable for application by friction, and if used alone they must be carefully applied, in restricted quantity, by means of a camel's-hair brush, or if by inunction, they must be combined with other oily liniments. By a judicious combination of the official liniments with one another, or with other medicinal substances soluble in them, a great variety of magistral formulæ may be contrived to suit all cases in which the skin is the more suitable channel for the application of the medicine.

LINIMENTUM.

Aconiti.	Powdered aconite root, *oz.* 20; camphor, *oz.* 1; rectified spirit, a sufficiency to make 30 *fl. oz.*
Ammoniæ.	Solution of ammonia, *fl. oz.* 1; olive oil, *fl. oz.* 3.
Belladonnæ.	Belladonna root, *oz.* 20; camphor, *oz.* 1; rectified spirit, a sufficiency to make 30 *fl. oz.*
Calcis.	Solution of lime, *fl. oz.* 2; olive oil, *fl. oz.* 2.

Camphoræ.	Camphor, *oz.* 1; olive oil, *oz.* 4.
Camphoræ Compositum.	Camphor, *oz.* $2\frac{1}{2}$; oil of lavender, *fl. dr.* 1; strong solution of ammonia, *fl. oz.* 5; rectified spirit, *fl. oz.* 15.
Chloroformi.	Chloroform, *fl. oz.* 2; liniment of camphor, *fl. oz.* 2.
Crotonis.	Croton oil, *fl. oz.* 1; oil of cajuput and rectified spirit, of each, *fl. oz.* $3\frac{1}{2}$.
Hydrargyri.	Ointment of mercury, *oz.* 1; solution of ammonia, *fl. oz.* 1; liniment of camphor, *fl. oz.* 1.
Iodi.	Iodine, *oz.* $1\frac{1}{4}$; iodide of potassium, *oz.* $\frac{1}{2}$; glycerine, *oz.* $\frac{1}{4}$; rectified spirit, *fl. oz.* 10.
Opii.	Tincture of opium, *fl. oz.* 2; liniment of soap, *fl. oz.* 2.
Potassii Iodidi cum Sapone.	Curd soap, *oz.* 2; iodide of potassium, *oz.* $1\frac{1}{2}$; glycerine, *fl. oz.* 1; oil of lemon, *fl. dr.* 1; distilled water, *fl. oz.* 10.
Saponis.	Hard soap, *oz.* 2; camphor, *oz.* 1; oil of rosemary, *fl. drs.* 3; rect. spirit, *fl. oz.* 16; distilled water, *fl. oz.* 4.
Sinapis Compositum.	Oil of mustard, *fl. dr.* 1; ethereal extract of mezereon, *gr.* 40; camphor, *gr.* 120; castor oil, *fl. dr.* 5; rectified spirit, *fl. oz.* 4.
Terebinthinæ.	Oil of turpentine, *fl. oz.* 16; soft soap, *oz.* 2; camphor, *oz.* 1; distilled water, *fl. oz.* 2.
Terebinthinæ Aceticum.	Oil of turpentine, *fl. oz.* 4; glacial acetic acid, 1 *oz.*; liniment of camphor, *fl. oz.* 4.

Liquores.—There are forty-eight formulæ for *Solutions* in the British Pharmacopœia. It is convenient to remember that the strength of the following solutions is *four grains* of the active ingredient *to the ounce*—viz., *Arsenicalis, Arsenici Hydrochloricus, Atropiæ, Atropiæ Sulphatis, Morphiæ Acetatis, Morphiæ Hydrochloratis, Potassæ Permanganatis, Sodæ Arseniatis, Strychniæ*, and that of the *Perchloride of Mercury* is $\frac{1}{2}$ grain to the ounce.

Liquor.

Acidi Chromici.	Chromic acid, *fl. oz.* 1; distilled water, *fl. oz.* 3.
Ammoniæ.	Strong solution of ammonia, *O* 1; distilled water, *O* 2; *sp. gr.* 0·959.
Ammoniæ Acetatis.	Strong solution of acetate of ammonium, *fl. oz.* 4; distilled water, a sufficiency to produce *fl. oz.* 20.
Ammoniæ Acetatis Fortior.	Carbonate of ammonium, *oz.* $17\frac{1}{2}$; acetic acid, *fl. oz.* 50, or a sufficiency; distilled water, a sufficiency.
Ammoniæ Citratis.	Strong solution of citrate of ammonium, *fl. oz.* 5; distilled water sufficient to produce *fl. oz.* 20.
Ammoniæ Fortior.	Chloride of ammonium, *lb.* 3; slaked lime, *lb.* 4; distilled water, *fl. oz.* 32.
Ammonii Citrate Fortior.	Citric acid, *oz.* 12; strong solution of ammonia, *fl. oz.* 11, or a sufficiency; distilled water, a sufficiency.

Antimonii Chloridi.	Purified black antimony, *lb.* 1 ; hydrochloric acid, *O* 4.
Arsenicalis.	Arsenious acid, *gr.* 87; carbonate of potassium, *gr.* 87; compound tincture of lavender, *fl. dr.* 5 ; distilled water, *Q.S.* to make *O* 1 ; *sp. gr.* 1·009.
Arsenici Hydrochloricus.	Arsenious acid, *gr.* 87; hydrochloric acid, *fl. dr.* 2 ; distilled water, *Q.S.* to make *O* 1.
Atropinæ Sulphatis.	Atropine, *gr.* 9 ; camphor water, *fl. oz.* 16½.
Bismuthi et Ammoniæ Citratis.	Citrate of Bismuth, *gr.* 800 ; solution of ammonia, distilled water, of each a sufficiency.
Calcis.	Slaked lime, *oz.* 2 ; distilled water, *C* 1.
Calcis Chloridi.	Chloride of calcium, 88 *gr.*; distilled water, *fl. oz.* 1.
Calcis Chlorinatæ.	Chlorinated lime, *lb.* 1 ; distilled water, *C* 1 ; *sp. gr.* 1·035.
Calcis Saccharatus.	Slaked lime, *oz.* 1 ; refined sugar, *oz.* 2 ; distilled water, *O* 1 ; *sp. gr.* 1·052.
Chlori.	Hydrochloric acid, *fl. oz.* 6 ; black oxide of manganese, *oz.* 1 ; distilled water, *fl. oz.* 34.
Epispasticus.	Cantharides, *oz.* 5 ; acetic acid, a sufficiency.
Ferri Acetatis.	Strong solution of acetate of iron, *fl. oz.* 5 ; distilled water, sufficient to produce after admixture, *fl. oz.* 20.
Ferri Acetatis Fortior.	Solution of persulphate of iron, *fl. oz.* 5 ; solution of ammonia, a sufficiency.
Ferri Dialysatus.	Strong solution of perchloride of iron, *fl. oz.* 7 ; solution of ammonia and distilled water, of each a sufficiency.
Ferri Perichloridi.	Strong solution of perchloride of iron, *fl. oz.* 5 ; distilled water, *fl. oz.* 20.
Ferri Perichloridi Fortior.	Iron wire, *oz.* 4; hydrochloric acid, *fl. oz.* 20½ nitric acid, *fl. dr.* 12; dist. water, a sufficiency.
Ferri Perinitratis.	Fine iron wire, *oz.* 1 ; nitric acid, *fl. oz.* 4½ ; distilled water, *Q.S.*, makes *O* 1½.
Ferri Perisulphatis.	Sulphate of iron, *oz.* 8 ; sulphuric acid, nitric acid, of each *fl. dr.* 6 ; distilled water, *fl. oz.* 12, or *Q.S.*, makes *fl. oz.* 11.
Gutta-percha.	Gutta-percha, *oz.* 1 ; chloroform, *fl. oz.* 8 ; carbonate of lead, *oz.* 1.
Hydrargyri Nitratis Acidus.	Mercury, *oz.* 4 ; nitric acid, *fl. oz.* 5 ; distilled water, *fl. oz.* 1½.
Hydrargyri Perchloridi.	Perchloride of mercury, chloride of ammonium, of each, *gr.* 10 ; distilled water, *O* 1.
Iodi.	Iodine, *gr.* 22 ; iodide of potassium, *gr.* 33 ; distilled water, *fl. oz.* 1.
Lithiæ Effervescens.	Carbonate of lithia, *gr.* 10 ; water, *O* 1.
Magnesii Carbonatis.	Sulphate of magnesia, *oz.* 2 ; carbonate of soda, *oz.* 2½ ; distilled water, *Q.S.*

Magnesiæ Citratis.	Carbonate of magnesium, *gr.* 100; citric acid, *gr.* 200; syrup of lemons, *fl. oz.* ½; bicarbonate of potassium, *gr.* 40; water, *Q.S.*
Morphinæ Acetatis.	Acetate of morphine, *gr.* 9; diluted acetic acid, *min.* 18; rectified spirit, *fl. dr.* 4; distilled water, *fl. oz.* 1½.
Morphinæ Hydrochloratis.	Hydrochlorate of morphine, *gr.* 4; diluted hydrochloric acid, *min.* 8; rectified spirit, *fl. dr.* 2; distilled water, *fl. dr.* 6.
Morphinæ Bimeconatis.	Hydrochlorate of morphine, *gr.* 9; solution of ammonia, a sufficiency; meconic acid, *gr.* 6; rectified spirit, *fl. oz.* ½; distilled water, a sufficiency.
Plumbi Subacetatis.	Acetate of lead, *oz.* 5; oxide of lead, *oz* 3½; distilled water, *O* 1, or *Q S.*, makes *fl. oz.* 20.
Plumbi Subacetatis Dilutus.	Solution of subacetate of lead, *fl. dr.* 2; rectified spirit, *fl. dr.* 2; distilled water, *fl. oz.* 19½.
Potassæ.	Carbonate of potassium, *lb.* 1; slaked lime, *oz.* 12; distilled water, *C* 1; *sp. gr.* 1·058.
Potassæ Effervescens.	Bicarbonate of potassium, *gr.* 30; water, *O* 1.
Potassæ Permanganatis.	Permanganate of potassium, *gr.* 88; distilled water, *O* 1.
Sodæ.	Carbonate of sodium, *oz.* 28; slaked lime, *oz.* 12; distilled water, *C* 1; *sp. gr.* 1·047.
Sodæ Arseniatis.	Arseniate of sodium (made anhydrous at a heat not above 300°), *gr.* 7; distilled water, *fl. oz.* 2.
Sodæ Chlorinatæ.	Carbonate of soda, *oz.* 16; black oxide of manganese, *oz.* 4; hydrochloric acid, *fl. oz.* 15; distilled water, *O* 2.
Sodii Ethylatis.	Metallic sodium, free from oxide, *gr.* 22; ethylic alcohol, *fl. oz.* 1.
Sodæ Effervescens.	Bicarbonate of sodium, *gr.* 30; water, *O* 1.
Strychninæ Hydrochloratis.	Strychnine, *gr.* 9; diluted hydrochloric acid, *min.* 14; rectified spirit, *fl. oz.* ½; distilled water, *fl. oz.* 1½.
Zinci Chloridi.	Granulated zinc, *lb.* 1; hydrochloric acid, *fl. oz.* 44; solution of chlorine, *Q.S.*; carbonate of zinc, *oz.* ½, or *Q.S.*; distilled water, *O* 1.

Lotions.—These are solutions of medicinal substances for external application. In practice they are very numerous, but they are chiefly prescribed *extempore.* Formulæ for two lotions are, however, contained in the British Pharmacopœia, viz., for black and yellow mercurial lotions.

LOTIO.

Hydrargyri Flava.	Perchloride of mercury, *gr.* 18; solution of lime, *fl. oz.* 10.
Hydrargyri Nigra.	Subchloride of mercury, *gr.* 30; solution of lime, *fl. oz.* 10.

Mellita.—There are four formulæ for *Honeys* in the British Pharmacopœia. One is simply for the depuration of honey, the others are for compound preparations somewhat like syrups, the sugar being replaced by honey. *Mel Rosæ* is omitted.

MEL.

Boracis.	Borax, *gr.* 60 ; clarified honey, *oz.* 1 ; glycerine, *gr.* 30.
Depuratum.	Honey, *lb.* 5 ; melt in a water-bath, and strain.
Oxymel.	Clarified honey, *oz.* 40 ; acetic acid, *fl. oz.* 5 ; distilled water, *fl. oz.* 5.
Oxymel Scillæ.	Vinegar of squill, *O* 1 ; clarified honey, *lb.* 2.

Misturæ.—There are ten formulæ for *Mixtures* in the British Pharmacopœia. These preparations are administered either alone or as adjuncts to and vehicles for other medicines. They are so prepared that they may be given in doses varying from half an ounce to two ounces.

MISTURA.

Ammoniaci.	Ammoniac, *oz.* ¼ ; distilled water, *fl. oz.* 8.
Amygdalæ.	Compound powder of almonds, *oz.* 2 ; distilled water, 16 *oz.*
Creasoti.	Creasote, *min.* 15 ; glacial acetic acid, *min.* 15 ; spirit of juniper, *fl. dr.* ½ ; syrup, *fl. oz.* 1 ; distilled water, *fl. oz.* 15.
Cretæ.	Prepared chalk, *oz.* ¼ ; gum acacia, *oz.* ¼ ; syrup, *fl. oz.* ½ ; cinnamon water, *fl. oz.* 7½.
Ferri Aromatica.	Red cinchona bark, *oz.* 1 ; calumba root, *oz.* ½ ; cloves, bruised, *oz.* ¼ ; fine iron wire, *oz.* ½ ; compound tincture of cardamoms, *fl. oz.* 3 ; tincture of orange peel, *fl. oz.* ½ ; peppermint water, *Q.S.*
Ferri Composita.	Sulphate of iron, *gr.* 25 ; carbonate of potash, *gr.* 30 ; myrrh, *gr.* 60 ; refined sugar, *gr.* 60 ; spirit of nutmeg, *fl. dr.* 4 ; rose water, *fl. oz.* 9½.
Guaiaci.	Guaiac resin, *oz.* ½ ; refined sugar, *oz.* ½ ; gum acacia, *oz.* ¼ ; cinnamon water, *O* 1.
Scammonii.	Scammony in powder, *gr.* 6 ; milk, *fl. oz.* 2.
Sennæ Composita.	Sulphate of magnesium, *oz.* 4 ; liquid extract of liquorice, *oz.* 1 ; tincture of senna, *oz.* 2½ ; compound tincture of cardamoms, *oz.* 1½ ; infusion of senna, *fl. oz.* 15.
Spiritus Vini Gallici.	Spirit of French wine, cinnamon water, of each, *fl. oz.* 4 ; the yolk of two eggs ; refined sugar, *oz.* ½.

Mucilagines.—There are three formulæ for *Mucilages* in the British Pharmacopœia. They are used to allay irritation of mucous membranes ; as vehicles for the combination of oils and resins with water in mixtures and enemata ; for suspending insoluble substances, as powders in mixtures ; and also for contributing to the constitution of lozenges.

MUCILAGO.

Acaciæ.	Gum acacia, *oz.* 4 ; distilled water, *fl. oz.* 6.
Amyli.	Starch, *gr.* 120 ; distilled water, *fl. oz.* 10.
Tragacanthæ.	Tragacanth, *gr.* 60 ; boiling dist. water, *fl. oz.* 10 ; rectified spirit, *fl. dr.* 2.

Pilulæ.—There are twenty-one formulæ for *Pills* in the British Pharmacopœia. The pill is an exceedingly useful form of medicine, and has long existed. It is round, sufficiently cohesive to prevent crumbling, firm enough to retain its shape, dry enough to prevent its sticking to its neighbours or to the fingers, soft enough to be easy of digestion, from three to five grains in weight, consists of substances that are compatible and that are active in small bulk, and is covered with some vegetable powder, French chalk, magnesia, sugar, silver, or gold leaf, or varnish, according to circumstances. Pills are perhaps more frequently prescribed *extemporaneously* and without reference to *official formulæ* than any other medicinal form. In constructing a *magistral* pill-formula the following points are to be considered. The pill is a suitable form :—

1. When the ingredients are active in minute quantities.
2. When the ingredients for each dose do not amount to more than five, or at most six, grains in weight; beyond that the pill becomes a *bolus*, and, though the mass were divided into two or more parts, still remains an obnoxious quantity. There are, however, exceptional cases, in which the relative weight of the ingredients, as to their bulk, is such as to allow of a pill weighing six or eight grains without attaining inconvenient size.
3. When a too sudden action of the medicine is to be avoided.
4. When the ingredients are such as cannot conveniently be given in a fluid or more bulky form, whether from the difficulty of suspending them, or from the offensive odour or taste of the active substances.
5. When the ingredients do not cause a rapid change in the pill mass, whether by *deliquescence* or *efflorescence*.

Besides powders and mineral preparations, the more common active ingredients of pills are extracts, resins, gum-resins, balsams, and essential oils.

Having determined upon the active ingredients, the next point is the choice of an *excipient* :—

1. The excipient will be hard or soft, dry or moist, according to the nature of the other ingredients, its chief object being to impart tenacity. Powders and dry substances require a liquid or soft excipient, whilst liquid or moist substances require a dry or absorbent excipient.
2. *Dry Excipients.*—Inert powders, bread crumb, and dry extracts are the chief.
3. *Moist Excipients.*—Water, oils, syrups, honey, treacle, confection of roses, alcohol, tinctures, vinegar, mucilage, soap, soft extracts, &c.

Some excipients soon leave the pills very dry and hard, and are therefore not suitable when the pills are to be kept for some time; others soon give rise to mouldiness. The choice of an excipient is important, therefore, not only with the view of obtaining a due consistency, but also for the preservation of the mass in a plastic and unaltered condition. Sometimes the choice or quantity of an excipient is left to the dispenser, whilst at other times he is obliged to depart from the strict letter of the prescription, because the ingredients ordered are not capable of being formed into a pill. But the physician who has passed through a sufficient course of practical pharmacy is never straitened in his knowledge of what is required to form a suitable medicine, except, perhaps, occasionally as to some points of a chemical nature, which are only gradually coming to the knowledge of even thoroughly practical pharmaceutists. Sometimes a prescription is written for a single pill, with directions to the dispenser to send a certain number of such to the patient; at other times larger quantities are prescribed to form a mass, with directions to the dispenser to divide the quantity into so many pills. In both instances the latter plan is adopted by the dispenser. Pills have been coated with a variety of substances, with the view of preserving them from the atmosphere, and of protecting the patient from their disagreeable odour and taste, without, at the same time, interfering with their solubility in the alimentary canal. Several substances have been used for this purpose, such as gelatine, collodion, albumen, Canada balsam, white wax, the tincture of tolu, lac, sandarach, &c. When a sufficient number of pills are sent to a patient to serve for longer than a few days, especially if they contain any fugitive ingredients, they should be sent in well-corked bottles, in which they keep much better than in boxes.

PILULA.

Aloes Barbadensis. Bardadoes aloes, *oz.* 2; hard soap, *oz* 1; oil of caraway, *fl. dr.* 1; confection of roses, *oz.* 1.

Aloes et Assafœtidæ. Socotrine aloes, *oz.* 1; assafœtida, *oz.* 1; hard soap, *oz.* 1; confection of roses, *oz.* 1.

Aloes et Ferri.	Sulphate of iron, *oz.* 1½; Bardadoes aloes, *oz.* 2; compound powder of cinnamon, *oz.* 3; confection of roses, *oz.* 4.
Aloes et Myrrhæ.	Socotrine aloes, *oz.* 2; myrrh, *oz.* 1; saffron, *oz.* ½; treacle, *oz.* 1; glycerine, a sufficiency.
Aloes Socotrinæ.	Socotrine aloes, *oz.* 2; hard soap, *oz.* 1; volatile oil of nutmeg, *fl. dr.* 1; confection of roses, *oz.* 1.
Assafœtidæ (Galbani) Composita.	Assafœtida, *oz.* 2; galbanum, *oz.* 2; myrrh, *oz.* 1; treacle, by weight, *oz.* 1.
Cambogiæ Composita.	Gamboge, *oz.* 1; Barbadoes aloes, *oz.* 1; compound powder of cinnamon, *oz.* 1; hard soap, *oz.* 2; syrup, *Q.S.*
Colocynthidis Composita.	Colocynth, *oz.* 1; Barbadoes aloes, *oz.* 2; resin of scammony, *oz.* 2; sulphate of potash, *oz.* ¼; oil of cloves, *fl. dr.* 2; distilled water, *Q.S.*
Colocynthidis et Hyoscyami.	Compound pill of colocynth, *oz.* 2; extract of hyoscyamus, *oz.* 1.
Conii Composita.	Extract of hemlock, *oz.* 2½; ipecacuanha powder, *oz.* ½; treacle, *Q.S.*
Ferri Carbonatis.	Saccharated carbonate of iron, *oz.* 1; confection of roses, *oz.* ¼.
Ferri Iodidi.	Fine iron wire, *gr.* 40; iodine, *gr.* 80; refined sugar, *gr.* 70; liquorice root, *gr.* 140; distilled water, *min.* 50.
Hydrargyri.	Mercury, *oz.* 2; confection of roses, *oz.* 3; liquorice root, *oz.* 1.
Hydrargyri Subchloridi Composita.	Subchloride of mercury, sulphurated antimony, of each *oz.* 1; guaiacum resin, *oz.* 2; castor oil, *fl. oz.* 1, or *Q.S.*
Ipecacuanhæ cum Scilla.	Compound powder of ipecacuanha, *oz.* 3; squill and ammoniac, in powder, of each *oz.* 1; treacle, *Q.S.*
Phosphori.	Phosphorus, *gr.* 3; balsam of tolu, *gr.* 120; yellow wax, *gr.* 57; curd soap, *gr.* 90.
Plumbi cum Opio.	Acetate of lead, *gr.* 36; opium, *gr.* 6; confection of roses, *gr.* 6.
Rhei Composita.	Rhubarb, *oz.* 3; socotrine aloes, *oz.* 2¼; myrrh, *oz.* 1½; hard soap, *oz.* 1½; oil of peppermint, *fl. dr.* 1½; glycerine, *oz.* 1; treacle by weight, about *oz.* 3.
Saponis Composita.	Opium, *oz.* ½; hard soap, *oz.* 2; glycerine a sufficiency.
Scammonii Composita.	Resin of scammony, resin of jalap, curd soap, of each, *oz.* 1; strong tincture of ginger, *fl. oz.* 1; rectified spirit, *fl. oz.* 2.
Scillæ Composita.	Squill, *oz.* 1¼; ginger, *oz.* 1; ammoniac, *oz.* 1; hard soap, *oz.* 1; treacle, by weight, *oz.* 2, or *Q.S.*

Pulveres.—There are fifteen formulæ for *Powders* in the British Pharmacopœia. Powders are given either because it is desirable that the medicine should be administered in its integrity, in a form that can be readily attacked by the stomach, and, perhaps, that by simple mechanical action it should produce certain effects; or else, because the substances or the circumstances are not suited to the pill, mixture, or confection forms. The disadvantages attending their use are chiefly their bulk, rendering the dose disagreeable to the patient, that they generally contain a large quantity of inert matter, and that many of them are apt to undergo a deleterious change by keeping. The more minutely powders are divided the more powerful and prompt is their constitutional effect; the coarser they are the more prominent is their topical effect. Powders are either simple or compound; simple when the substance is single, compound when two or more are combined. Compound powders are to be prepared with great care; they should contain no deliquescent substance, and the ingredients should be thoroughly mixed. When they are kept in quantities, they should be occasionally well shaken, because the heavier particles, by frequent concussions of the vessel containing the powders, have a tendency to gravitate, leaving the lighter particles at the top. Powders that contain fugitive ingredients should be sent out in wide-mouthed bottles, well corked or stoppered, leaving it to the patient to apportion the doses; or, if it be necessary to dispense such powders separately, they may be wrapped in an outer covering of waxed paper or tin-foil. Powders that are given in bulky doses, and that are not very active in their operations, may accumulate in the bowels if given for a length of time. To prevent this inconvenience an occasional laxative is to be prescribed.

PULVIS.

Amygdalæ Compositus. (*Confectio, Conserva Amygdal.*)	Sweet almonds. *oz.* 8; refined sugar, *oz.* 4; gum acacia, *oz.* 1.
Antimonialis.	Oxide of antimony, *oz.* 1; phosphate of lime, *oz.* 2.
Catechu Compositus.	Catechu, *oz.* 4; kino, *oz.* 2; rhatany, *oz.* 2; cinnamon, *oz.* 1; nutmeg, *oz.* 1.
Cinnamomi Compositus.	Cinnamon bark, cardamom seeds, and ginger, of each, *oz.* 1.
Cretæ Aromaticus. (*Confectio Aromatica.*)	Cinnamon, *oz.* 4; nutmeg, *oz.* 3; saffron, *oz.* 3; cloves, *oz.* $1\frac{1}{2}$; cardamom seeds, *oz.* 1; prepared chalk, *oz.* 11; refined sugar, *oz.* 25.
Cretæ Aromaticus cum Opio.	Aromatic powder of chalk, *oz.* $9\frac{3}{4}$; opium, *oz.* $\frac{1}{4}$.
Elaterii Compositus.	Elaterin, *gr.* 5; sugar of milk, *gr.* 195.

Glycyrrhizæ Compositus.	Senna, liquorice root, of each, *oz.* 2; fennel fruit, *oz.* 1; sublimed sulphur, *oz.* 1; refined sugar, *oz.* 6.
Ipecacuanhæ Compositus.	Ipecacuan, *oz.* ½; opium, *oz.* ½; sulphate of potash, *oz.* 4.
Jalapæ Compositus.	Jalap, *oz.* 5; acid tartrate of potash, *oz.* 9; ginger, *oz.* 1.
Kino Compositus.	Kino, *oz.* 3¾; opium, *oz.* ¼; cinnamon bark, *oz.* 1.
Opii Compositus.	Opium, *oz.* 1½; black pepper, *oz.* 2; ginger, *oz.* 5; caraway fruit, *oz.* 6; tragacanth, *oz.* ½.
Rhei Compositus.	Rhubarb, *oz.* 2; light magnesia, *oz.* 6; ginger, *oz.* 1.
Scammonii Compositus.	Scammony, resin, *oz.* 4; jalap, *oz.* 3; ginger, *oz.* 1.
Tragacanthæ Compositus.	Tragacanth, *oz.* 1; gum acacia, *oz.* 1; starch *oz.* 1; refined sugar, *oz.* 3.

Spiritus.—There are eighteen formulæ for *Spirits* in the British Pharmacopœia. Some of the old spirits are omitted, some are altered in name and character, and a new class is formed, consisting of *Cajuput*, *Camphor*, *Juniper*, *Lavender*, *Peppermint*, *Nutmeg*, and *Rosemary*, made from the Essential oils, in the uniform proportion of one to forty-nine.

SPIRITUS.

		Rect. Spirit.	Sp. Gr.
Ætheris.	Ether, *fl. oz.* 10.	*O* 1	0·809
Ætheris Compositus.	Sulphuric acid, *oz.* 36.	*O* 2	
Ætheris Nitrosi.	Nitric acid, *fl. oz.* 3. Sulphuric acid, *fl. oz.* 2. Copper wire, *oz.* 2.	*Q.S.*	0·845
Ammoniæ Aromaticus.	Carbonate of ammonia, *oz.* 4. Strong solution of ammon., *fl. oz.* 8. Volatile oil of nutmeg, *fl. dr.* 4½. Oil of lemon, *fl. dr.* 6½. Water, *O* 3.	*O* 6	0·870
Ammoniæ Fœtidus.	Assafœtida, *oz.* 1½. Strong solution of ammon., *fl. oz.* 2.	*Q.S.*	
Armoraciæ Compositus.	Horseradish, *oz.* 20. Bitter orange peel, *oz.* 20. Nutmeg, *oz.* ½; proof spirit, *C* 1. Water, *O* 2.		
Cajuputi.	Oil of cajuput, *fl. oz.* 1.	*fl. oz.* 49	
Camphoræ.	Camphor, *oz.* 1.	*fl. oz.* 9	
Chloroformi.	Chloroform, *fl. oz.* 1.	*fl. oz.* 19	0·871
Cinnamonii.	Oil of cinnamon, *fl. oz.* 1.	*fl. oz.* 49	
Juniperi.	Oil of juniper, *fl. oz.* 1.	*fl. oz.* 49	
Lavandulæ.	Oil of lavender, *fl. oz.* 1.	*fl. oz.* 49	
Menthæ Piperitæ.	Oil of pepperment, *fl. oz.* 1.	*fl. oz.* 49	

		Rect. Spirit.	Sp. Gr.
Myristicæ.	Volatile oil of nutmeg, *fl. oz.* 1. .	*fl. oz.* 49	
Rectificatus.	Alcohol, with 16 per cent. of water.		0·838
Rosmarini.	Oil of rosemary, *fl. oz.* 1. . .	*fl. oz.* 49	
Tenuior.	Distilled water, *O* 3. . .	*O* 5	0·920
Vini Gallici.	Spirit distilled from French wine.		

Succi.—There are five formulæ for *Juices* in the British Pharmacopœia. Freshly exposed juices of plants were first introduced by Mr Squire thirty years ago; five are now made official. In the preparation of juices from fresh plants, the hazard attending the drying of the plant is avoided, and also the dangers which attend evaporation in the process for extracts. To each three parts of the juice obtained by expression, one part of rectified spirit is added to preserve it from decomposition. The juices form an excellent illustration of the influences of climate, soil, and season upon medicinal plants, their value being greatly modified by these causes.

Succus.

Belladonnæ.	Fresh leaves of belladonna, *lb.* 7; rectified spirit, 1 part to 3 of juice.
Conii.	Fresh leaves of hemlock, *lb.* 7; rectified spirit, 1 part to 3 of juice.
Hyoscyami.	Fresh leaves of hyoscyamus, *lb.* 7; rectified spirit, 1 part to 3 of juice.
Scoparii.	Fresh broom tops, *lb.* 7; rect. spirit, 1 part to 3 of juice.
Taraxaci.	Dandelion root, *lb.* 7; rectified spirit, 1 part to 3 of juice.

Suppositoria.—There are seven formulæ for *Suppositories* in the British Pharmacopœia. Suppositories will be again considered when treating of the various channels by which medicines are introduced into the system.

Suppositoria.

Acidi Carbolici-cum sapone.	Carbolic acid, *gr.* 12; curd soap, *gr.* 180; glycerine of starch, *gr.* 40, *Q.S.*; makes 12.
Acidi Tannici.	Tannic acid, *gr.* 36; oil of theobroma, *gr.* 144.
Acidi Tannici-cum sapone.	Tannic acid, *gr.* 36; glycerine of starch, *gr.* 30; curd soap, *gr.* 100; starch, *Q.S.*; makes 12.
Hydrargyri.	Ointment of mercury, *gr.* 60; oil of theobroma, *gr.* 120; makes 12.
Iodoformi.	Iodoform in powder, *gr.* 36; oil of theobroma, *gr.* 144.
Morphinæ.	Hydrochlorate of morphia, *gr.* 6; oil of theobroma, *gr.* 174; makes 12.
Morphinæ cum sapone.	Hydrochlorate of morphina, *gr.* 6; glycerine of starch, *gr.* 30; curd soap, *gr.* 100; starch, *Q.S.*; makes 12.
Plumbi Composita.	Acetate of lead, *gr.* 36; opium, in powder, *gr.* 12; oil of theobroma, *gr.* 132; makes 12.

Syrupi.—There are seventeen formulæ for *Syrups* in the British Pharmacopœia. Some of the old syrups are omitted, and there are, moreover, additions and alterations. The chief difficulties attending the preservation of syrups are their tendencies to ferment and become mouldy if too weak, and to crystallise when too strong. In order to prevent these results, the Pharmacopœia directs, in most cases, that the product of each syrup to be obtained from the ingredients ordered shall be of a certain fixed weight, thus determining at the same time their consistency. Good syrups are of a certain weight in proportion to the ingredients used—of a certain density—are free from crystals and muddiness—are made with the purest sugar—and must be kept in a cool place, and in vessels nearly full. Bottles half full, or vessels loosely covered, tend to injurious changes through crystallisation of the sugar. When they are to be kept for some time they may be poured into bottles whilst hot, the bottles being immediately well corked and then inverted. Syrups are charged with medicinal substances, and are used either alone, for the sake of their active ingredients, or as adjuvants to other medicines, to preserve them, to give them an agreeable flavour, or to promote their activity.

SYRUPUS.

		Refined Sugar.	Product.	Gr. Sp.
Syrupus.	Distilled water, *O* 2.	5 lb.	7½ lb.	1·330
Aurantii.	Tincture of orange peel, *fl. oz.* 1 ; syrup, *fl. oz.* 7.			
Aurantii Floris.	Orange flower water, *fl. oz.* 8 ; distilled water, *fl. oz.* 16, or *Q.S.*	3 lb.	4½ lb.	1·330
Chloral.	Hydrate of chloral, *gr.* 80 ; distilled water, *fl. dr.* 1½ ; simple syrup, *Q.S.*			
Ferri Iodidi.	Fine iron wire, *oz.* 1 ; iodine, *oz.* 2 ; dist. water, *fl. oz.* 13.	28 oz.	2 lb. 11 oz.	1·385
Ferri Phosphatis.	Granulated sulphate of iron, *gr.* 224 ; phosphate of sodium, *gr.* 200 ; bicarbonate of sodium, *gr.* 56 ; concentrated phosphoric acid, *fl. oz.* 1¼ ; distilled water, *fl. oz.* 8.	8 oz.	*fl. oz* 12, by measure.	
Hemidesmi.	Hemidesmus, *oz.* 4 ; boiling distilled water, *O* 1.	28 oz.	2 lb. 10 oz.	1·335
Limonis.	Fresh lemon peel, *oz.* 2 ; lemon juice, *O* 1.	2¼ lb.	3½ lb.	1·340
Mori.	Mulberry juice, *O* 1 ; rectified spirit, *fl. oz.* 2½.	2lb.	3 lb. 6 oz.	1·330

		Refined Sugar.	Product.	Sp. Gr.
Papaveris.	Poppy capsules, freed from seeds, *oz.* 36 ; boiling dist. water, *Q.S.;* rectified spirit, *fl. oz.* 16.	4 lb.	$6\frac{1}{2}$ lb.	1·320
Rhei.	Rhubarb root, coriander fruit, of each *oz.* 2; rectified spirit, *fl. oz.* 8 ; distilled water, *fl. oz.* 24.	24 oz.		
Rhæados.	Red poppy petals, *oz.* 13; dist. water, *O* 1, or *Q.S.*; rect. spirit, *fl. oz.* $2\frac{1}{2}$.	$2\frac{1}{4}$ lb.	3 lb. 10 oz.	1·330
Rosæ Gallicæ.	Dried red-rose petals, *oz.* 2 ; boiling dist. water, *O* 1.	30 oz.	2 lb. 14 oz.	1·335
Scillæ.	Vinegar of squill, *O* 1.	$2\frac{1}{2}$ lb.		1·330
Sennæ.	Senna, *oz.* 16; oil of coriander, *min.* 3 ; dist. water, *O* 5, or *Q.S.;* rect. spirit, *fl. oz.* 2.	24 oz.	2 lb. 10 oz.	1·310
Tolutanus.	Balsam of tolu, *oz.* $1\frac{1}{4}$; dist. water, *O* 1, or *Q.S.*	2 lb.	3 lb.	1·330
Zingiberis.	Strong tincture of ginger, *fl. dr.* 6 ; syrup, *fl. oz.* 19.			

Tabellæ.—This is a new form of pharmaceutical preparation introduced into the Pharmacopœia of 1886 for the first time, in the form of

TabellæNitroglycerini. Tablets of chocolate, each weighing two and a half grains, and containing one hundredth of a grain of pure nitroglycerine.

Tincturæ.—There are seventy-two formulæ for *Tinctures* in the British Pharmacopœia. Different kinds of spirit are used, as menstrua, in the preparation of the tinctures, according to the solubility of the active principles to be abstracted from the substances from which they are prepared. *Rectified and proof spirits, aromatic spirit of ammonia, and spirit of ether* are used. Some of the tinctures prepared by the stronger spirits assume a milky appearance when they are diluted with water, the spirit being no longer able to keep the resinous or oily ingredients in solution. To obviate this result, when given in the form of mixture, the addition of mucilage is necessary to suspend the insoluble substances. The method of preparing tinctures has been considerably modified by the British Pharmacopœia, a change which has not given general satisfaction. Before the publication of the Pharmacopœia, there were two rival processes, *maceration* and *percolation*, and there was not a little speculation as to which of these would be adopted. The result has been termed a *compromise.* Sixteen of the tinctures (*marked b. in the following ar-*

rangement) are prepared by the old process of *maceration*. Forty-five of the tinctures (*marked a.*) are prepared by a union of the two processes, *maceration* followed by *percolation*. The seven tinctures marked *c.* are prepared by simply dissolving the ingredients in the spirit.

British Pharmacopœia Process for the forty-five Tinctures marked a.—"Macerate for forty-eight hours, with fifteen ounces of the spirit, in a close vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, pour into the percolator the remaining five ounces of the spirit. As soon as the percolation is completed, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient spirit to make one pint."

Process for the Sixteen Tinctures marked b.—"Macerate for seven days, filter (strain, express), and add sufficient spirit to make one pint," except *Spt. Lavand. Co.*, in which case rectified spirit is added to make two pints.

TINCTURA.

a. Macerate 48 hours and percolate ; *b.* Macerate 7 days ; *c.* Dissolve in the spirit. Product, *O* 1. Except **O* 2.

		Spirit. Rectified.	Spirit. Proof.
a. Aconiti.	Aconite root, *oz.* 2½.	*O* 1	
b. Aloes.	Socotrine aloes, *oz.* ½. Extract of liquorice, *oz.* 1½.		*Q.S*
a. Arnicæ.	Arnica root, *oz.* 1.	*O* 1	
b. Assafœtidæ.	Assafœtida, *oz.* 2½.	*Q.S.*	
a. Aurantii.	Bitter orange peel, *oz.* 2.		*O* 1
b. Aurantii Recentis.	Bitter orange peel, a sufficiency.	*O* 1	
a. Belladonnæ.	Belladonna leaves, *oz.* 1.		*O* 1
b. Benzoini Composita.	Benzoin, *oz.* 2. Prepared storax, *oz.* 1½. Balsam of tolu, *oz.* ½. Socotrine aloes, *gr.* 160.	*O* 1	
a. Buchu.	Buchu, *oz.* 2½.		*O* 1
a. Calumbæ.	Calumba, *oz.* 2½.		*O* 1
b. Camphoræ Composita. (*Tinct. Opii Camphorata.*)	Opium, *gr.* 40. Benzoic acid, *gr.* 40. Camphor, *gr.* 30. Oil of anise, *fl. dr.* ½.		*O* 1
c. Cannabis Indicæ.	Extract of Indian hemp, *oz.* 1.	*O* 1	
a. Cantharidis.	Cantharides, *oz.* ¼.		*O* 1
a. Capsici.	Capsicum, *oz.* ¾.	*O* 1	
a. Cardamomi Composita.	Cardamoms, *oz.* ¼. Caraway, *oz.* ¼. Raisins, *oz.* 2. Cinnamon, *oz.* ½. Cochineal, *gr.* 60.		*O* 1

		Spirit. Rectified.	Spirit. Proof.
a. *Cascarillæ.*	Cascarilla, *oz.* 2½.		*O* 1
a. *Catechu.*	Catechu, *oz.* 2½. Cinnamon, *oz.* 1.		*O* 1
a. *Chiratæ.*	Chiretta, *oz.* 2½.		*O* 1
c. *Chloroformi Composita.*	Chloroform, *fl. oz.* 2; compound tincture of cardamoms, *fl. oz.* 10.	*fl. oz.* 8.	
Chloroformi et Morphinæ.	Chloroform, oz. 1; ether, *fl. dr.* 2; rectified spirit, *oz.* 1; hydrochlorate of morphine, *grs.* 8; dilute hydrocyanic acid, *oz.* ½; oil of peppermint, *m.* 4; liquid extract of liquorice, *oz.* 1; treacle, *oz.* 1; syrup, a sufficiency.		
Cimicifugæ.	Cimicifuga, *oz.* 2½.		*O* 1
a. *Cinchonæ Composita.*	Red cinchona bark, *oz.* 2. Bitter orange peel, *oz.* 1. Serpentary, *oz.* ½. Saffron, *gr.* 55. Cochineal, *gr.* 28.		*O* 1
a. *Cinchonæ Flavæ.*	Red cinchona bark, *oz.* 4.		*O* 1
a. *Cinnamoni.*	Cinnamon, *oz.* 2½.		*O* 1
b. *Cocci.*	Cochineal, *oz.* 2½.		*O* 1
a. *Colchici Seminum.*	Colchicum seed, *oz.* 2½.		*O* 1
a. *Conii.*	Hemlock fruit, *oz.* 2½.		*O* 1
a. *Croci.*	Saffron, *oz.* 1.		*O* 1
a. *Cubabæ.*	Cubebs, *oz.* 2½.	*O* 1	
a. *Digitalis.*	Digitalis, *oz.* 2½.		*O* 1
a. *Ergotæ.*	Ergot, *oz.* 5.		*O* 1
c. *Ferri Acetatis.*	Strong solution of acetate of iron, *oz.* 5; acetic acid, *oz.* 1; rectified spirit, *oz.* 5; distilled water, *oz.* 9.		
c. *Ferri Perchloridi.*	Strong solution of perchloride of iron, *fl. oz.* 5.	*fl. oz.* 15. (*sp.gr.* 0·992).	
a. *Gallæ.*	Galls, *oz.* 2½.		*O* 1
Gelsemii.	Gelsemium, *oz.* 2½.		
a. *Genntianæ Composita.*	Gentian, *oz.* 1½. Bitter orange peel, *oz.* ¾. Cardamoms, *oz.* ¼.		*O* 1
b. *Guaiaci Ammoniata.*	Guaiac resin, *oz.* 4. Aromatic spirit of ammonia, *Q.S.*		
a. *Hyosami.*	Hyoscyamus leaves, *oz.* 2½.		*O* 1
c. *Iodi.*	Iodine, *oz.* ½; iodide of potassium, *oz.* ½.	*O* 1	
Jaborandi.	Jaborandi, *oz.* 5.		*O* 1
a. *Jalapæ.*	Jalap, *oz.* 2½.		*O* 1

		Spirit. Rectified.	Spirit. Proof.
b. Kino.	Kino, *oz.* 2; glycerine, *oz.* 3; distilled water, *oz.* 5; rectified spirit, *oz.* 12.	*O* 1	
a. Krameriæ.	Rhatany, *oz.* $2\frac{1}{2}$.		*O* 1
a. Laricis.	Larch bark, *oz.* $2\frac{1}{2}$.	*O* 1	
b. and c. Lavandulæ Composita.	Oil of lavender, *fl. dr.* $1\frac{1}{2}$. Oil of rosemary, *min.* 10. Cinnamon, *gr.* 150. Nutmeg, *gr.* 150. Red sandal wood, *gr.* 300.	*O* 2*	
a. Limonis.	Fresh lemon peel, *oz.* $2\frac{1}{2}$.		*O* 1
a. Lobeliæ.	Lobelia, *oz.* $2\frac{1}{2}$.		*O* 1
b. Lobeliæ Ætherea.	Lobelia, *oz.* $2\frac{1}{2}$; spirit of ether, *O* 1.		
a. Lupuli.	Hop, *oz.* $2\frac{1}{2}$.		*O* 1
a. Myrrhæ.	Myrrh, *oz.* $2\frac{1}{2}$.	*O* 1	
a. Nucis Vomicæ.	Extract of nux vomica, *gr.* 133; distilled water, *oz.* 4.	*Q.S.*	
b. Opii.	Opium, *oz.* $1\frac{1}{2}$.		*O* 1
b. Opii Ammoniata.	Opium, in coarse powder, *gr.* 100; saffron and benzoic acid, of each *gr.* 180; oil of anise, *fl. dr.* 1; strong solution of ammonia, *fl. oz.* 4.	*fl. oz.* 16.	
Podophylli.	Resin of podophyllum, *gr.* 160.	*O* 1	
a. Pyrethri.	Pellitory root, *oz.* 4.	*O* 1	
b. Quassiæ.	Quassia wood, *oz.* $\frac{3}{4}$.		*O* 1
b. Quiniæ.	Hydrochlorate of quinina, *gr.* 160; tincture of orange peel, *O* 1.		
c. Quiniæ Ammoniata.	Sulphate of quinina, *gr.* 160; solution of ammonia, *oz.* $2\frac{1}{2}$.		*oz.* $17\frac{1}{2}$
a. Rhei.	Rhubarb, *oz.* 2; cardamoms, *oz.* $\frac{1}{4}$; coriander, *oz.* $\frac{1}{4}$; saffron, *oz.* $\frac{1}{4}$.		*O* 1
a. Sabinæ.	Savin, *oz.* $2\frac{1}{2}$.		*O* 1
a. Scillæ.	Squill, *oz.* $2\frac{1}{2}$.		*O* 1
a. Senegæ.	Senega, *oz.* $2\frac{1}{2}$.		*O* 1
a. Sennæ.	Senna, *oz.* $2\frac{1}{2}$; raisins, *oz.* 2; caraway, *oz.* $\frac{1}{2}$; coriander, *oz.* $\frac{1}{2}$.		*O* 1
a. Serpentariæ.	Serpentary, *oz.* $2\frac{1}{2}$.		*O* 1
a. Stramonii.	Stramonium seeds, *oz.* $2\frac{1}{2}$.		*O* 1
a. Sumbul.	Sumbul root, *oz.* $2\frac{1}{2}$.		*O* 1
c. Tolutana.	Balsam of tolu, *oz.* $2\frac{1}{2}$.	*Q.S.*	
a. Valerianæ.	Valerian, *oz.* $2\frac{1}{2}$.		*O* 1
b. Valerianæ Ammoniata.	Valerian, *oz.* $2\frac{1}{2}$; aromatic spirit of ammonia, *O* 1.		
a. Veratri Viridis.	Green hellebore root, *oz.* 4.	*O* 1	
a. Zingiberis.	Ginger, *oz.* $2\frac{1}{2}$.	*O* 1	
a. Zingiberis Fortior.	Ginger, *oz.* 10.	*Q.S.*	

Trochisci.—There are twelve formulæ for *Lozenges* in the British Pharmacopœia. This form of medicine is adopted from the Edinburgh Pharmacopœia. The product in each case is 720 lozenges.

TROCHISCI. Product, 720 Lozenges.		Refined Sugar. oz.	Gum Acacia. oz.	Mucilage of Gum. fl. oz.	Distilled Water. Quantity. fl. oz.
Acidi Benzoici.	Benzoic acid, *gr.* 360.	25	1	2	*Q.S.*
Acidi Tannici.	Tannic acid, *gr.* 360; tincture of tolu, *fl. oz.* ½.	25	1	2	1
Bismuthi.	Subnitrate of bismuth, *gr.* 1440; carbon. of magnesium, *oz.* 4; precipitated carb. of calcium, *oz.* 6	25	1	2	(rose water.) *Q.S.*
Catechu.	Pale catechu, *gr.* 720.	25	1	2	*Q.S.*
Ferri Redacti.	Reduced iron, *gr.* 720.	25	1	2	1 or *Q.S.*
Ipecacuanhæ.	Ipecacuanha, *gr.* 180.	25	1	2	1 or *Q S.*
Morphinæ.	Hydroch. of morphine, *gr.* 20; tincture of tolu, *fl. oz.* ½.	24	1	*Q.S.*	½
Morphinæ et Ipecacuanh.	Hydroch. of morphia, *gr.* 20; ipecacuan, *gr.* 60; tincture of tolu, *fl. oz.* ½.	24	1	*Q.S.*	½
Opii.	Extract of opium, *gr.* 72; tincture of tolu, *fl. oz.* ½; extract of liquorice, *oz* 6.	16	2	...	*Q.S.*
Potassæ Chloratis.	Chlorate of potash, *gr.* 3600.	25	1	2	1 or *Q.S.*
Sodii Bicarbonatis.	Bicarbonate of sodium, *gr.* 3600.	25	1	2	1
Santonini.	Santonin, *gr.* 720.	25	1	2	1

Unguenta.—There are forty-three formulæ for *Ointments* in the British Pharmacopœia. The old *cerates* are either omitted or merged in the ointments, the name having been abandoned. There are several omissions, additions, and alterations amongst the ointments. The consistence of ointments may be modified by altering the quantity of wax or oil—the former giving stiffness, the latter softness, to the preparation, and in most of the ointments Benzoated Lard, or a combination of soft and hard Paraffin has been substituted for Lard. In the dispensing of ointments the following particulars are to be observed :—1. To reduce the active ingredients to an impalpable state, so that there may be no *grittiness* in the ointment. 2. This reduction may be effected by powdering, if the substance be capable of it, or otherwise by dissolving it in a few drops of spirit or other menstruum. 3. To distribute the active ingredients uniformly through the ointment. Ointments are used only externally, sometimes simply as emollients, at other times as vehicles for the most powerful remedies, *e.g.*, *Unguentum Aconitiæ*.

Unguentum.		Benzoated Lard. oz.	Simple Ointments. oz.
Acidi Borici.	Boric acid, *oz.* 2½; soft paraffin, *oz.* 10; hard paraffin, *oz.* 5.		
Acidi Carbolici.	Carbolic acid, *gr.* 60; soft paraffin, *gr.* 720; hard paraffin, *gr.* 360.		
Acidi Salicylici.	Salicylic acid, *gr.* 60; soft paraffin, *gr.* 1080; hard paraffin, *gr.* 540.		
Aconitinæ.	Aconitine, *gr.* 8; rect. spirit, *fl. dr.* ½.	1	
Antimonii Tartarati.	Tartarated antimony, *oz.* ¼. .		1
Atropinæ.	Atropine, *gr.* 8; rect. spirit, *fl. dr.* ½.	1	
Belladonnæ.	Alcoholic extract of belladonna, *gr.* 50.	1	
Calaminæ.	Prepared calamine, *oz.* 1; benzoated lard, *oz.* 1.		
Cantharidis.	Cantharides, *oz.* 1; yellow wax, *oz.* 1; olive oil, *fl. oz.* 6.		
Cetacei.	Spermaceti, *oz.* 5; white wax, *oz.* 2; almond oil, *O* 1, or *Q.S.*		
Chrysarobini.	Chrysarobin, *gr.* 20; benzoated lard, *gr.* 480.		
Creasoti.	Creasote, *fl. dr.* 1. . . .		1
Elemi.	Elemi, *oz.* ¼ . . .		1
Eucalypti.	Oil of Eucalyptus, *oz.* 1; soft paraffin and hard paraffin, of each *oz.* 2.		
Gallæ.	Galls, *gr.* 80; benzoated lard, *oz.* 1.		
Gallæ cum Opio.	Ointment of galls, *oz.* 1; opium, *gr.* 32.		
Glycerini Plumbi Subacetatis.	Glycerine of subacetate of lead, *oz.* 4½; soft paraffin, *oz.* 18; hard paraffin, *oz.* 6.		
Hydrargyri.	Mercury, *lb.* 1; prepared suet, *oz.* 1.	16	
Hydrargyri Ammoniati. (*Unguentum Præcip. Albi.*)	Ammoniated mercury, *gr.* 62. .		1
Hydrargyri Compositum.	Ointment of mercury, *oz.* 6; yellow wax, olive oil, of each, *oz.* 3; camphor, *oz.* 1½.		
Hydrargyri Iodidi Rubri.	Red iodide of mercury, *gr.* 16. .		1
Hydrargyri Nitratis. (*Unguentum Citrinum.*)	Mercury, by weight, *oz.* 4; nitric acid, *fl. oz.* 12; olive oil, *fl. oz.* 32.	15	
Hydrargyri Nitratis Dilutuni.	Nitrate of mercury ointment, *oz.* 1; soft paraffin, *oz.* 2.		
Hydrargyri Oxidi Rubri. (*Unguen. Hydrar. Nitrico Oxidi.*)	Red oxide of mercury, *gr.* 62; yellow wax, *oz.* ¼; oil of almonds, *oz.* ¾.	1	

		Benzoated Lard. oz.	Simple Ointments. oz.
Hydrargyri Subchloridi.	Subchloride of mercury, *gr.* 80.		
Iodi.	Iodine, *gr.* 32; iodide of potas., *gr.* 32; proof spirits, *fl. dr.* 1.	2	
Iodoformi.	Iodoform, *oz.* 1; benzoated lard, *oz.* 1.		
Picis Liquidæ.	Tar, *oz.* 5; yellow wax, *oz.* 2.		
Plumbi Acetatis.	Acetate of lead, *gr.* 12; benzoated lard, *oz.* 1.		
Plumbi Carbonatis.	Carbonate of lead, *gr.* 62.		1
Plumbi Iodidi.	Iodide of lead, *gr.* 22.		1
Plumbi Subacetatis Compositum.	Solution of subacetate of lead, *fl. oz.* 6; camphor, *gr.* 60; white wax, *oz.* 8; oil of almonds, *O* 1.		
Potassæ Sulphuratæ.	Sulphurated potash, *gr.* 30; soft paraffin, *oz.* ¾; hard paraffin, *oz.* ¼.	1	
Potassii Iodidi.	Iodide of potassium, *gr.* 64; carbonate of potash, *gr.* 4; distilled water, *fl. dr.* 1.	1	
Resinæ.	Resin, *oz.* 8; yellow wax, *oz.* 4.		16
Sabinæ.	Fresh savin, *oz.* 8; yellow wax, *oz.* 3.	16	
Simplex.	White wax, *oz.* 2; almond oil, *fl. oz.* 3.	3	
Staphisagriæ.	Stavesacre seeds, *oz.* 4; benzoated lard, *oz.* 8.		
Sulphuris.	Sublimed sulphur, *oz.* 1; benzoated lard, *oz.* 4.		
Sulphuris Iodidi.	Iodide of sulphur, *gr.* 30; hard paraffin, *oz.* ¼; soft paraffin, *oz.* ¾.		
Terebinthinæ.	Oil of turpentine, *fl. oz.* 1; resin, *gr.* 54; yellow wax, *oz.* ½.	½	
Veratrinæ.	Veratrine, *gr.* 8; hard paraffin, *oz.* ¼; soft paraffin, *oz.* ¾; olive oil, *dr.* 1.	1	
Zinci.	Oxide of zinc, *gr.* 80; benzoated lard, *oz.* 1.		
Zinci Oleate.	Oleate of zinc, *oz.* 1; soft paraffin, *oz.* 1.		

Vapores.—In conformity with a growing impression that inhalation is a mode of administering remedies, more especially for affections of the chest, which is at once agreeable and effective, a class of formulæ has been introduced into the British Pharmacopœia, fixing the proportions of certain medicinal agents when used for inhalations. Vessels made of stoneware, suitable for this purpose, are now to be procured from most druggists. The formulæ for inhalations, six in number, are—

Vapor.

Acidi Hydrocyanici.	Diluted hydrocyanic acid, *min.* 10-15; water, *fl. dr.* 1.
Chlori.	Chlorinated lime, *oz.* 2; water (cold), *Q.S.*
Coninæ.	Juice of hemlock, *oz.* ½; solution of potash, *fl. dr.* 1; distilled water, *fl. drs.* 10; *min.* 20, of mixture on a sponge.
Creasoti.	Creasote, *min.* 12; boiling water, *fl. oz.* 8.
Iodi.	Tincture of iodine, *fl. dr.* 1; distilled water, *fl. oz.* 1.
Olei pini Sylvestris.	Fir wool oil, *min.* 40; light carbonate of magnesium, *gr.* 20; water, a sufficiency.

Vina.—There are eleven formulæ for *Wines* in the British Pharmacopœia. The medicated wines hold medicinal substances in solution, and are used much in the same way as the tinctures. Sherry is the menstruum in most of the official wines, and the quality of the preparation will depend upon its soundness. It should contain 17 or 18 per cent. of alcohol. Orange wine should contain about 12 per cent. of alcohol.

Vinum.

Product *O* 1. Except Aloes *O* 2.

		Sherry.	
Aloes.	Socotrine aloes, *oz.* 1½; cardamoms, *gr.* 80; ginger, *gr.* 80.	*O* 2	digest 7 days.
Antimoniale.	Tartarated antim., *gr.* 40.	*O* 1	dissolve.
Aurantii.	Wine made in Britain, by fermentation of a saccharine solution, to which the fresh peel of the bitter orange has been added.		
Colchici.	Colchicum corm, *oz.* 4.	*O* 1	macerate 7 days.
Ferri.	Fine iron wire, *oz.*	*O* 1	macerate 30 days.
Ferri Citratis.	Citrate of iron and ammonium, *gr.* 160; orange wine, *O* 1.		dissolve, and let stand 3 days.
Ipecacuanhæ.	Ipecacuan, *oz.* 1; acetic acid, oz. 1; distilled water a sufficiency.	*O* 1	macerate 7 days.
Opii.	Extract of opium, *oz.* 1; cinnamon bark, cloves, of each *gr.* 75.	*O* 1	Do. do.
Quiniæ.	Sulphate of quinina, *gr.* 20; citric acid, *gr.* 30; orange wine, *O* 1.		macerate 3 days.
Rhei.	Rhubarb root, oz. 1½; canella alba bark, *gr.* 60.	*O* 1	macerate 7 days.
Xericum.	Sherry,—a Spanish wine.		

Besides the general titles of official formulæ, others are employed to distinguish certain classes of medicine, such as *Collyrium*, or eye-wash; *Elixir*, a term formerly applied to compound tinctures, *e.g.*, *Paregoric Elixir* (*Tinct. Camph. Comp.*, P.L.), *Elixir Proprietatis* (*Tinct. Aloes Comp.*, P.L.), *Daffy's Elixir* (*Tinct. Sennæ Comp.*, P.L.), &c.; *Emulsion*, a mixture containing oleaginous or resinous ingredients held in suspension by means of yolk of egg, mucilage, or sugar; *Essential oil*, an oil obtained from odoriferous plants by distillation or expression. These thirty oils in the British Pharmacopœia, of which twenty-one are distilled and eight expressed from vegetable substances, the remaining one being extracted from the fresh liver of the cod by a steam heat, not exceeding 180° F. The term of *Julep* is synonymous with *Mistura;* the present *Aqua Camphoræ* was formerly called *Mistura Camphoræ* or *Camphor Julep. Linctus* is a thin electuary, such as can be *licked* (*lingo*) off the spoon.

Granular Effervescing Powders.—These are a recent invention, and form a distinct class of elegant and useful remedies. They consist of an active medicinal substance in union with the *Citro-tartrate of Sodium.* The ingredients *Citric Acid*, *Tartaric Acid*, and *Bicarbonate of Sodium*, finely divided, are mixed together and heated until, by the water of crystallisation of the citric acid, the ingredients are converted into a plastic mass. This is dried and granulated by passing it through a coarse sieve. During the operation a part only of the carbonic acid escapes, the remainder being fixed in the solid granular particles, each of which, when dissolved in water, parts with more of the gas, so that when a large quantity of the substance is stirred in water it gives rise to a brisk sparkling effervescence. Preparations of magnesia, iron, quinina, lithia, &c., have been made in combination with granular effervescing powders.

Granules were first prepared by *Messrs Homolle & Quevenne.* They consist of the more active medicinal substances enveloped in sugar. They are usually made with very active remedies. The *Granules of Digitaline* contain one-sixtieth of a grain of Digitaline in each.

Capsules.—Capsules of gelatine, sugar, or gum are employed to envelop medicines which are apt to create disgust by their odour or taste. Copaiva, cubebs, castor oil, and many other remedies may be so given.

MAGISTRAL FORMULÆ OR PRESCRIPTIONS.

We come now to the consideration of matters with which the physician alone has to do. Hitherto we have had the assistance of the *collector* or *cultivator*, the *merchant*, and the *dispenser* of drugs. We have been learning from experienced practical teachers how to *select* and *collect* the *Materia Medica* from their sources in nature; how to reproduce certain of them by *cultivation;* how to *preserve* them; how to *prepare* them for use; and, by the ordinances of the British Pharmacopœia, how *to reduce them to forms most convenient for application.* We have been chiefly in consultation with that invaluable physician's friend, the *Pharmaceutical Chemist.* But we have now passed out of his domain; he will still attend to our wants, but he can no longer help us to a decision. Our responsibility is henceforward *undivided.* We are alone with our patient: we have examined him; and having pronounced his malady, we come to the momentous question, *Why*, *what*, *when*, and *how* shall we prescribe for him? This quadruple question involves the consideration of several important points, such as—1. The meaning of the terms *properties*, *forces*, *actions*, and *effects* of *medicines.* 2. The *modus operandi* and *classification* of medicines. 3. The *locality* of the action of medicines. 4. The several methods of *applying* medicines to the patient. 5. The circumstances which *modify* the actions of medicines. 6. *The construction of the Prescription.*

Now, it is plain that to deal with these questions in any beyond the briefest possible manner, would completely change at once the character and usefulness of the *Note-Book;* and that to attempt a brief exposition of the doctrines concerned in them, whilst it would assuredly lead to misconceptions, could be of little or no practical value. I shall therefore give no more than a mere sketch of the subject here; the object of the *Note-Book* being to awaken the student's interest to these important matters, and to show what is to be learned from the lectures and from extended treatises, rather than to supply the details of the subject.

1. The Properties, Forces, Actions, and Effects of Medicines.—All medicines are endowed with *properties* which, when quickened into activity, are called *forces.* The properties and forces of medicines are divisible into three classes:—(*a*) *Physical*, or *Mechanical;* (*b*) *Chemical;* (*c*) *Dynamical*, or *vital.*

We understand by the physical properties of medicines all those qualities by which we recognise them without the aid of chemistry; and of these properties, such as are appreciable by the senses, as form, colour, odour, and taste, are distinguished by the term *sensible*, or, as the French call them, *organoleptic*, properties. The chemical properties of substances are those which relate to their composition and to the changes which take place in their constitution by their mutual action upon one another.

The *dynamical* properties of medicines are those by which they produce in the living organism certain effects which are directly referable neither to physical nor chemical force. We have examples of this property in the action of certain inorganic bodies upon each other, of which, perhaps, the action of the magnet upon a steel rod, previously destitute of polarity, is the simplest illustration. If a steel rod or needle, in which there is no magnetic manifestation, be suspended horizontally from its centre, in such a manner that the suspending agent does not control its movements, the bar or needle may be brought to a state of rest with its extremities pointed in any direction, and will remain in that position until some external force is applied to overcome its inertia. But if a magnet be passed over the needle from end to end, and the needle be again suspended, we shall find that a change has taken place. It will no longer remain quietly in the position in which it may be placed, as before, but so soon as the force that placed it in any other position is removed, it will spontaneously assume the position of having one of its extremities pointing to the north and the other to the south. But the needle is otherwise the same as before : we can appreciate no physical or chemical change in its constitution ; nor can we discover the manifestation of any physical or chemical force in the magnet; and the force which has evidently been in operation is therefore simply called *dynamical* (δύναμις, *power*). So it is also with certain medicines: they are applied to the organism, and a manifest change takes place ; but as we can neither refer the change to a physical nor chemical action. we say, in the absence of a more satisfactory explanation, that it is due to the *dynamical* or *vital* properties of the agent.

When a medicine is brought into relationship with the organism, its properties are quickened, its forces come into operation, the *action* of the remedy is manifested, and there follows a series of results which may collectively be termed the *medicinal effect*. This effect is of a twofold character: first, there is the effect produced by the direct contact of the medicine with the part to which it is applied ; and, second, there is the result produced by the reaction of the organism as a consequence of the first effect. Effects are also divisible into *Primary*, or *Physiological*, and *Secondary*, or *Therapeutical*.

Physiological, *Primary*, or *Immediate* effects are the results which may be produced by medicines when applied to the organism during health. But health is not essential to their manifestation; they may arise in the presence of disease, and may either precede or accompany therapeutical effects. Thus, arsenious acid, if given in long-continued small doses, may give rise to a sensation of heat in the *primæ viæ*, nausea, purging, headache, cough, irregularity in the circulation, and many other indications of its presence in the system of a healthy person; and these are physiological effects. But if the person to whom the arsenic was given were suffering from a chronic cutaneous affection—such as *lepra* or *psoriasis*, the physiological effects might still arise, but the chain of events which led to the removal of the disease would constitute the *Secondary* or *Therapeutical* effect.

2. The Modus Operandi and Classification of Medicines.— It has been the desire of every age, as it is still the wish of every individual, to offer some explanation of the manner in which the results proceeding from certain causes are produced. The physician has not been less active in his endeavours than others to trace the footsteps of the cause to its effect. No physician would ever administer a dose of medicine without being able not only to foretell its effects, but also to demonstrate the *modus operandi*—that is, the method pursued by the medicine to fulfil its mission—if he could. No intelligent physician can ever give a dose of medicine without either supposing that he does understand the manner of its operation, or sighing for the explanation. And so strong is the desire of every observant mind to account for the effects witnessed during the treatment of disease, that we can scarcely be surprised at the numerous attempts that have been made, from time to time, to offer some reasonable explanation of the conduct of medicines during their presence in the human system. Some of these explanations have been mere assumptions, conclusions hastily drawn, for the sake of offering a plausible interpretation of certain phenomena—they are mere *hypotheses;* whilst others, founded upon philosophical principles, deserve the dignity of *theories.*

The actions of medicines have been referred to their physical, chemical, and dynamical or vital properties. By their physical and chemical properties, medicines may act in the living organism in the same way as they would act upon each other, under favourable circumstances, apart from living beings; but when it is said that medicines act *dynamically*, it is meant that they produce their effects by an unexplained influence over *vitality*, either by increasing, diminishing, or otherwise altering the powers of life. But the action of a medicine, it is said, may be of a compound character : it may be partly physical, or partly chemical, and partly dynamical or vital; and the action is then termed either *physico-vital* or *chemico-vital*, as the case may be. And when the action is in no way referable either to the physical or chemical force, it is said to be *purely vital.*

When we consider this complex subject at length, however, we shall find that not one of the theories offered in support of these assertions has been sufficient to afford a universal explanation of the actions of remedies. Many of them, it is true, are still unrefuted, and even now afford plausible explanations of the *modus operandi* of certain medicines; the chief objection urged against them being, not that they are altogether unreasonable and improbable, but that they are individually pushed too far. But not only has no single theory satisfied the intense desire for an explanation of the actions of medicines, but even the sum of all the theories leaves still a want which neither experience nor speculation has hitherto been able to supply. Nor is it surprising, when we consider the inconsistency of the grounds of argument. It is a very difficult matter to found a satisfactory theory upon the basis of individual experience; for, even during a long life of careful observation, the physician can scarcely expect to accumulate a sufficient number of cases, in all respects identical, upon which we can establish a definite *law* or *principle.* The experience of ages has failed in this; and the accumulation of statistics, however numerous, unless they be, as indeed they scarcely can be, in all respects identical will never reduce the science of therapeutics to exactness. It is the vital element—the ψυχὴ, πνεῦμα, *archæus, anima,* vital principle, call it what you please—that is the disturbing cause in all such calculations of the physicist, the chemist, and even of the vitalist; and, so long as that remains beyond human control, there can be no absolute certainty in the practice of medicine.

One of the most difficult points that the physician has to determine at the bedside is the exact effect of a medicine. A certain drug was administered yesterday, a certain change is observable to-day; is the change wholly, partly, or at all due to the medicine? One of the chief sources of fallacy in the practice of medicine is the ready application of the *post hoc, propter hoc* argument: a medicine has been given, a change follows, *therefore* the medicine *caused* the change. It is to this readiness to call mere sequences *effects* that we owe the short-lived remedies which occasionally startle the world as by a flash and a loud report, and then gradually vanish like the smoke of a cannon. But if it be a difficult matter to recognise the results of the medicine *after,* how much more difficult must it be to predicate its effects *before,* its administration. In his *Essay on the Human Understanding,* John Locke affords the following illustration of the *intro-mathematical* speculations. Reviving an old physical doctrine, he says—"If we could discover the figure, size, texture, and motions of the minute constitutional parts of any two bodies, we should know, without trial, several of their operations one upon another, as we do now the properties of the square or a triangle. Did we know the mechanical affections of the particles of rhubarb, hemlock, opium, and a man, as a watchmaker does those of a watch, whereby it performs its operations, and of a file, which, by rubbing on them, will alter the figure of any of the wheels, we should be able to tell beforehand that rhubarb will purge, hemlock kill, and opium make a man sleep." Very true, if the file, wheels, rhubarb, hemlock, opium, and man were alike simple and steadfast in constitution ; but they are not. The wheels of the watch and the file are constant and unchanging mechanical implements, having the same "affections" from day to day and year to year; whereas the mechanical and chemical "affections" of rhubarb, hemlock, and opium, and the mechanical, chemical, and, above all, the *vital* "affections" of the man are ever changing, and are in no two individuals alike. The same file will affect fifty different wheels in exactly the same manner, if applied in all cases alike, and fifty files applied equally to one wheel will produce identical effects. But the same sample of opium may affect fifty different individuals in as many different ways, according to the age, sex, development, temperament, idiosyncrasy, conditions of organs and their functions, the presence of disease, and other modifying causes present in each case; and it may, moreover, affect the same individual in different ways, according to the predominance of one or other of the above circumstances at different periods of life. And again, if fifty doses of opium were given, in succession, to one individual, from samples of the drug prepared under as many different circumstances of climate, soil, elevation, season, mode of collecting, &c., each dose might produce a different effect. Man is not a machine, to be operated upon as a watchmaker deals with a watch. When the watch stops, the watchmaker can readily enough replace the broken spring, and set it in motion again; but the springs of life are of Divine origin, not of human manufacture. The heart beats and the lungs breathe, unaided by a single human thought, and when their movements cease, no human power can revive them. Analogy offers at best but a feeble support to the doctrines of the actions of medicines, even when it is drawn from experiments made upon the lower animals; but it is utterly inadequate when it compares the highest of God's creatures with the ordinary products of that creature's workmanship—animated beings with things inanimate. No comparison of a man with a watch or a steam engine can constitute a proof of the silent and invisible changes which occur in the human frame; nor can any results obtained by manipulations in the workshop of the mechanic, or the chemical laboratory, be accepted as serious indications of the treatment proper to the vital economy.

But we have also another important element to consider in reference to the organism: suppose, for the sake of brevity, we speak of disease as *disordered vitality*, then we find that there exists in the organism itself an innate tendency to the *restoration of order*, by means of a force which we call *vis medicatrix naturæ*—the *healing power of nature*. Most physicians pay great deference to this force; but in pursuing this course, the vitalists have often gone as far wrong as the physicists and the chemists. The indications of nature are, doubtless, of the utmost value, and the Latin phrase is probably near the truth that says *medicus curat, natura sanat morbos*—the physician *cures*—that is, takes care of the patient, in the sense, if we may use analogy, in which the pilot takes care of a vessel in a storm—but nature *heals* the disease. What, perhaps, is most wanted, in the present state of Therapeutics, is a combined effort on the part of physicians to ascertain, by means of extensive and accurate observation, how far the unaided efforts of nature are capable of restoring to health; or, in other words, what is the *natural history* of diseases. If anything approaching to scientific accuracy were ever effected in this direction, it would be then comparatively easy to judge correctly regarding the value of any particular medicine or mode of treatment. But in the present state of our knowledge, we are not warranted in adopting the exclusive doctrines of Hippocrates or of Hahnemann. We owe a deep debt of gratitude to the zealous labourers in this department of medical investigation; but even they would scarcely ask the student to commit himself at once to their doctrines, and to receive them as the unchallenged expositions of the actions of medicines. All that can be demanded of him is, that he shall give them his careful consideration, reserving the expression of his opinions regarding them for maturer years, when credulity and scepticism, after many a conflict, shall have found a common level in his mind. In the lectures devoted to this part of the subject, the doctrines of the various schools are usually reviewed; but they are too bulky to admit of being placed in the *Note-Book*. And here I would only further add a single caution to the student against the hasty acceptance of speculations, whether of the physicist, the chemist, or the vitalist, which, from an acquaintance with but the two ends of the chain—the initial cause and the ultimate effect—profess to solve the mystery of those intervening links which lie hidden in the recesses of the vital economy.

Seeing that the actions of medicines are not fully understood, it is obvious that no trustworthy *classification* can at present be established upon the basis of their *modus operandi*. To a certain extent, perhaps, this most desirable method of classification may be available; but until much that is now obscure with respect to the actions of medicines be brought to light, its use must necessarily be very limited. Nevertheless, a classification of some kind is necessary. We can readily conceive the difficulty that would be constantly felt in a large library, in which the books were placed at random upon the shelves, without reference to number, name, or subject. To facilitate the consultation of books various plans are adopted: they may be arranged alphabetically, according to the names of the authors, or according to the titles of the book; or they may be classified according to the subjects treated of—*history* here, *geography* there; here *biography*, there *novels*, and so on.

So it is also with medicines. To place them at random upon the shelves of the pharmaceutist, or to treat of them in a disorderly manner in books, would cause great confusion and loss of time in searching for individual remedies, whilst, at the same time, the memory would be clumsily overloaded, and many useful medicines would, from time to time, fall out of mind, and be lost on the journey of life. To obviate such difficulties, medicines have been arranged in classes, according to the views entertained of the relative value of classifications by the different writers on Materia Medica. Almost every writer on the subject has his own peculiar classification, either entirely novel, or merely an emendation upon the arrangement of a previous author. Hence there is a great variety of classifications, none of which, however, is perfect, because the basis of the classification is in no instance adapted to the whole list of Materia Medica; whilst on the other hand, few, if any, medicines can be restricted to a single class. And so we find, upon comparing the classifications of different authors, that the classes which are adopted by some are ignored by others; and that even those classes which have received general adoption are frequently represented in the various works by different medicines.

In some works the medicinal substances are arranged simply in alphabetical order, like the words in a dictionary. This plan, like the rest, has its advantages and disadvantages. It is a convenient form for consultation, because the book can be opened at the place where the substance is to be found without reference to an index. In works thus arranged, we generally meet with a definite, concise, and exhaustive account of the substance in one spot, and are spared the annoyance of frequent references to other parts of the work. The disadvantages are, chiefly, that it prevents continuous reading, whilst it does not in all cases supersede the necessity for an index, seeing that medicines possessed of several names can only be classified by one of them.

In other works, the classification is made with reference to the physical properties of medicines; obviously a very imperfect plan. One of the conceits of the physicists was, that every medicinal substance afforded, in one or another of its external characters, an indication of its therapeutic value, and a guide to its exhibition. In this hypothesis originated the absurd *Doctrine* of *Signatures*, the promoters of which maintained that every medicinal substance presented in one of its sensible properties a likeness to some part of the organism, that these similarities were the results of *astral* influences, and that such relations of colour, shape, &c., were trustworthy indications of the applicability of the medicine to the diseases of the part which it resembled. Each of such marks or characters was called a *signature*. Thus, the root of the *mandrake* was recommended as a cure for sterility, because of its supposed resemblance to the human form; *tumeric* was a cure for jaundice, because of its yellow colour; *poppies* for diseases of the head; *aristolochia* for uterine diseases, and so forth; whilst a covering of red cloth, being the same colour as the blood, served to attract that fluid to the surface of the body.

But even more recently the sensible qualities of medicines have been proposed as indications of their therapeutic value, and classifications of medicines have been made according to their colour, taste, and smell. That substances which are allied by taste or smell, or both, are frequently also alike in medicinal action, is undeniable; bitter substances are generally used as tonics; substances with a fetid odour are often used as antispasmodics; sweetish mucilaginous substances as demulcents; harshly-tasting substances as astringents; and hot-tasting substances as carminatives. With respect to colour, we have no well-marked classes. Other therapeutic indications are held to exist in the form, weight, &c., of remedies; as examples of which are quoted the hairs of the pods of *Mucuna pruriens*, silica, glass, the woody fibre of vegetable substances given in bulk, quicksilver, the class of demulcents, &c. We should, however, scarcely adventure a couple of drachms of sulphate of zinc, or of oxalic acid, merely because these compounds are not unlike Epsom salts, nor, in short, should we be justified in the use of any untried substance, simply from an acquaintance with its sensible properties.

Still another method of classification upon physical or mechanical principles remains to be adverted to; namely, that which is based upon the theory of the *modus operandi* of medicines by their influence upon the *osmotic force*. It is supposed that there are certain medicines which act by controlling the transference of fluids through living animal membranes, either by altogether preventing the passing of the fluids, or by determining the intensity of the *endosmotic* or *exosmotic* current. If this idea be well founded, it becomes a matter of the deepest importance, seeing that life itself is sustained by a regular interchange of nutrient and effete matters, conducted through intervening membranes by means of the physico-vital process of *osmosis.* This question is intimately related to that of *absorption*, and requires more space for its elucidation than the *Note-Book* allows.

Again, affinity of botanical characters has been proposed as an indication of similarity of medicinal virtues. This analogy may certainly be traced to a considerable extent, but it is by no means a safe guide, and no physician would be justified in administering an untried remedy on the sole ground that it was derived from a family containing several useful medicinal plants. The umbelliferæ are generally harmless, yet the order contains hemlock, a most deadly poison; the Solanaceæ, even when separated by a more accurate botanical analysis from the Atropaceæ, with which they used to be classified, still contain the potato, a valuable and nutritious esculent, and alongside of it the bitter-sweet, an active poison; and we would err very far did we administer aloes, squill, and asparagus indiscriminately, because they are all derived from the natural family *Liliaceæ.* Moreover, substances possessed of similar medicinal properties may be collected from different natural families, such as digitalis (*Scrophulariaceæ*), tobacco (*Atropaceæ*), and lobelia (*Lobeliaceæ*), which are all depressents.

Again, the chemical relations of substances have been proposed as indications of their therapeutic value; but here, too, we shall find that the exceptions so far outnumber the instances upon which the law is based, as to render this mode of classifying medicines also well-nigh practically useless. There is, however, something far more intricate and subtle about the chemical than about the physical relations of substances, and this we may pause for a moment to inquire into. The important differences to be observed between the physical and chemical forces are chiefly these: that whilst the physical force can be manifested both in similar and dissimilar bodies, the chemical force can be developed only between dissimilar bodies; and that whilst the physical force does not, as a general rule, permanently alter the properties of the bodies subjected to its influence, the chemical force generally produces a permanent change. And it is important to remember especially one point with reference to the chemical force in relation to medicinal substances, namely, that we cannot foretell the result of its manifestation. Bodies, either elementary or compound, which might be administered alone with impunity, may, if given together, in consequence of the manifestation of the force of *chemical affinity*, produce most disastrous results. The elementary bodies, carbon, hydrogen, and nitrogen, for example, may be applied to the organism individually, within certain limits, without producing any injurious effects; and in various combinations they enter into the human constitution. Judging by the individual characters of these elementary bodies, we could not possibly infer that they were able to assume a form in which they are capable of destroying life, even when exhibited in exceeding small quantity. No mere mechanical mixture could effect this change; but we know from experience, that by *chemical affinity* these elements can assume the form of HCN, one of the swiftest and most destructive poisons, *prussic acid*. Carbon, hydrogen, nitrogen, and oxygen, which are in themselves comparatively harmless bodies, assume very different characters, according to the relations which they bear to each other when influenced by chemical affinity. The following chemical formulæ are not very unlike each other, they are constituted of the same elements, and differ only in the number of atoms of each—$C_{21}H_{22}N_2O_2$; $C_{17}H_{19}NO_3H_2O$; $C_{20}H_{24}N_2O_2$; $C_{32}H_{52}N_2O_8$—and yet how different are their medicinal properties; the first represents *strychnina*, the second *morphina*, the third *quinina*, and the fourth *veratrina*. Moreover, substances which are alike, not only in the number, but also in the proportions of their constituents, may differ widely in their medicinal and physical as well as their other chemical properties; thus the formula $C_{10}H_{16}$ represents equally the oils of turpentine, lemons, oranges, bergamot, chamomile, cloves, thyme, and many others. *Isomerism* (ἴσος, *equal*, μέρος, part) is no greater proof of identity of medicinal properties than *isomorphism* (ἴσος, equal, μορφή, *form*). Substances which are made up of constituents alike in quality and quantity, may differ widely in their properties, according to their molecular arrangement. By analysis, we can ascertain the number and proportion of the elementary constituents present in a substance, but not the form in which the molecules are arranged; chemistry has not yet revealed this mystery in the economy of nature.

It must be obvious, therefore, even from the few examples quoted, that the proposition to judge of the medicinal activity of substances simply by their physical or chemical properties cannot be sustained to any great extent. Neither *isomerism* nor *isomorphism*, neither similarity in constitution nor likeness in form, can enable us unexceptionably to foretell the action of a medicine, even upon purely chemical or mechanical principles, supposing all other circumstances to be constant; much less will it enable us to foresee the nature of the effects that will be produced under the influence of the compound *chemico-vital* or *physico-*

vital forces. But, on the other hand, in favour of chemical classifications, it is to be borne in mind that there are certain analogies of chemical properties and medicinal actions which cannot be overlooked. We have examples of these in the mineral and vegetable acids; in the *halogens*, iodine, chlorine, and bromine; in the alkalies, potash, soda, and lithia; in the alkaline earths, magnesia, lime, baryta, and strontia, &c.; but even in these instances the *identity* is not equal to the *diversity* of medicinal action.

Again, medicines have been classified according to the parts of plants or animals from which they are derived, an arrangement that has been but little respected.

Again, medicines may be classified according to their physiological and therapeutical action upon the lower animals, as ascertained by observation or experiment. Of all the plans hitherto mentioned this is by far the most trustworthy, because in it, for the first time, the vital element is brought into operation. But still it would be very unsafe to administer a substance to a human being upon no better authority than that it had previously been applied to a horse, a dog, or a rabbit, with benefit or impunity. Sheep, goats, and cows eat the leaves of *hyoscyamus niger* with impunity. Enormous quantities of arsenic, tartar emetic, and belladonna have been given to horses without producing untoward effects. Albers gave morphina and opium to rabbits in doses that would have destroyed several human beings, but they produced no narcotic results. The anatomical differences between man and the lower animals are quite sufficient to nullify the actions of medicines in the latter as criteria of their effects upon the former. Nevertheless, observations and experiments made upon the lower animals are of great value, for by them many facts have been ascertained with respect to the conduct of different medicines, and of the same medicine under different circumstances, in the animal economy, which could not have been elicited by experiment upon human beings.

Of the methods now mentioned, it may be stated that, neither individually nor collectively are they sufficient to constitute a sound basis for the classification of medicines, nor trustworthy indications of the actions and effects of medicinal substances in the human system. Like the symptoms of disease, each has a relative significance which may, and ought to be, duly estimated, but singly cannot be relied on.

Then, finally, medicines may be classified according to their physiological and therapeutical actions in the human system. These are the only satisfactory methods of classification, and they are still very deficient. We cannot enter here into these questions, because they involve all the considerations of the actions of medicines ; but this may be said, that even when these most desirable classifications are constructed, they must necessarily give rise to many exceptions, varying not only with the *individuality* of the patient, but also with the characters of the disease. The action of a medicine upon a person in health cannot be accepted as the criterion of its action in the presence of disease; nor can the action of a medicine be certainly predicted in any individual case. It may be modified by many circumstances, pertaining equally to the patient and the drug itself, as we shall show more fully hereafter. And again, medicines are not to be restricted to a single class, for they act in a variety of ways, according to the manner in which they are administered: thus, tartar emetic may be a diaphoretic, expectorant, or emetic; quinina, a tonic, or a febrifuge; calomel, an alterative, a cathartic, or a sialagogue; squill, an emetic, cathartic, diuretic, or expectorant; or all may be given as poisons.

Medicines may be classified physiologically, either according to effects, which are obvious, or according to the changes which they are supposed to produce within the system, but of which there is no immediate external manifestation. Of the former, we have an instance in that comprehensive class called *evacuants*, comprising substances which cause discharges from one or other part of the body: if from the skin, they are *diaphoretics;* if from the nose, *errhines;* if from the bowels, *catharti;* if from the lungs, *expectorants.* Of the latter we have examples in *alteratives* and *tonics.*

It is easier to classify medicines physiologically than therapeutically, because it is easier experimentally to trace the cause of aberration than that of restoration. The natural condition of the body is health—a state, it is true, that cannot be maintained without a due attention to the necessities of life, but which, nevertheless, under favourable circumstances, is its normal state; whilst disease is a departure from the normal condition, and is caused either by a positive injury, as by a stroke or a poison, or by deprivation, as of food, heat, light, exercise, &c. But there is always a tendency, sometimes feeble and unavailing, but invariably present—the *vis medicatrix naturæ*—an innate tendency to return to the normal condition of health; and it is the conflicting influence of this *healing power of nature* that renders a therapeutical classification the more difficult.

No medicine is worthy of a place in either of these classifications until it has repeatedly, and under a variety of circumstances, manifested its qualifications; and these are more readily tested physiologically than therapeutically. An illustration will explain this more clearly. A medicine is administered to a person in health, and soon afterwards it is observed that his pulse beats less rapidly than before;

the dose is repeated, and the pulsations are still slower. The experiment is frequently repeated, under a variety of circumstances, and upon several persons of different qualities, and the result is invariably a reduction in the number of pulsations. Such a medicine may then be fairly classed with *arterial sedatives*. Again, the same medicine is administered as frequently to the same number of persons, all suffering from acute inflammation and an abnormally rapid circulation. A reduction in the rate of arterial pulsation follows; but in this case the proof of the sedative influence of the medicine is not so strong, simply because it is in the direction of, whereas in the former case it was opposed to, the tendency of nature. Or, to take another illustration; suppose a ball to be hanging quiescently at the end of a string, and it is desired to prove that two instruments, when alternately brought near to it, have an opposite effect upon it, the one gradually setting it in motion, the other gradually bringing it to a state of rest. By repeatedly observing the fact, that on the approach of one of the instruments the ball begins to move, at first gently, and then more rapidly, we should conclude that the instrument was the cause of the motion. But of the influence of the second instrument to bring the ball gradually to a state of rest, we should be more doubtful, simply because, if left alone, the ball would of itself become quiescent. In the one case the proof is positive, in the other negative. Nevertheless, we are not to despair of attaining a therapeutical classification. We shall not arrive at it by mere speculation, not by *ex parte* chemical, physiological, or pathological theories, but by close practical observation. All our trustworthy remedies have been introduced and confirmed clinically, experimentally, or, if you will, empirically, and not hypothetically. Practical therapeutics can be studied only at the bedside, where alone the student, aided by chemistry, physiology, and pathology, can learn to be a wise and prudent physician. The trustworthy practitioner is the chemist, physiologist, pathologist, therapeutist, all in one; it is only when the mere man of science approaches the bedside that we encounter those specious, and often captivating, speculations, which have hitherto retarded, rather than promoted, the practice of medicine.

3. **The Locality of the Action of Medicines.**—When a medicine is applied to the organism, its action may be manifested either at the point of contact, or at a distant part of the body, or in both places. When the action of the medicine is developed at the point of contact, it is said to be *topical* or *local;* when at a distant part, it is said to be *remote*. The topical action of a medicine is modified chiefly by two circumstances—the quality and state of aggre-

gation of the medicine, and the sensibility, and qualities of the secretions, of the part to which it is applied. A medicine may exhibit a topical and no perceptible remote action; or contrariwise, a remote action without any perceptible local effects.

Various explanations have been urged as to the manner in which medicines produce their remote effects. The chief are these: *by absorption into the circulation, by nervous agency or sympathy, by contiguity of organs, by continuity of tissue, and by revulsion;* and doubtless, to a limited extent, medicines may manifest their remote action through any of these channels; but greater interest attaches to the two former methods,—the nervous agency and the circulation,—for it is between the supporters of them that the keenest controversies have arisen. The majority of medicines probably exercise their remote effects by being absorbed into the circulation by means of the veins, and, to a less extent, by the lymphatics and lacteals; but there are some medicines whose remote effects may be due partly or entirely to nervous agency.

It is probable that no solid particles can be taken into the circulation; and, therefore, it is generally stated that medicines to be absorbed must be either given in a state of solution, or must be capable of solution in the secretions of the alimentary canal, or other parts to which they are applied. They must be soluble, too, without decomposition; or if decomposition takes place, the resulting compounds must be capable of producing the desired effects. The agents by which medicines, administered in a solid form, may be rendered soluble, or by which they may be otherwise operated upon, when administered in the usual way by the digestive apparatus, are the *acids, alkalies, alkaline chlorides,* and other peculiar principles of the gastric and intestinal juices.

4. Channels by which Medicines are introduced into the System.—All parts of the body are capable of absorbing medicinal substances, but not with equal energy and rapidity. And, moreover, the several tissues to which medicines are applied, exercise, through their secretion, a modifying influence upon the remedies. Medicines may be introduced through mucous membranes, skin, and subjacent cellular tissue, serous membranes, wounds, and vessels.

Mucous Membrane.—Of this there are two tracts :—1. In relation with the eyes, ears, nose, pulmonary apparatus, and alimentary canal. 2. Genito-urinary.

1. *The Gastero-enteric, Pulmonary, &c., Tract of Mucous Membrane.*— Of the larger tract, the mucous membrane of the stomach and intestines is most frequently used for the exhibition of medicines, chiefly

lants or sedatives, astringents or escharotics, according to the circumstances of the case. Applications to the conjunctiva should be made with extreme caution, for irreparable mischief may be done by their abuse. Lead collyria should be avoided where the conjunctiva is broken, otherwise a permanent opacity may result.

Medicines are occasionally applied to the *Eustachian membrane* for local purposes, but this practice should be followed with extreme caution; and medicinal applications even to the *meatus auditorius externus* are not to be made indiscriminately.

The membrane lining the air-passages is very susceptible, and medicines applied to it act powerfully, as they are exposed to an exceedingly large absorbing surface. Formerly, this membrane was much more frequently used for the administration of medicinal substances than it is at present. The practice of *inhalation* and *fumigation* is chiefly confined to local purposes, as for the relief of distressing symptoms in chronic bronchitis, asthma, phthisis, &c.; but it is also employed to induce general anæsthesia, and as a channel for the introduction of stimulants, such as the vapour of ammonia, aromatic vinegar, &c. Impalpable powders and powerful gases are rarely exhibited by this method now, though formerly much vaunted. Aqueous vapour, either alone or charged with some medicinal substance, is often inhaled with advantage in affections of the air-passages—a process which may be readily affected by holding the head over a basin of hot water, by cautiously inhaling it from the spout of a lightly-covered teapot, or by the use of one of the many instruments invented for the purpose. Fumes for inhalation are created in a variety of ways—as by saturating paper in a solution of the medicine, and, when dry, burning it in the sick chamber, or by throwing medicinal substances upon hot coals, and directing the fumes into the room. Medicated *cigars* and *cigarettes* are also used. Dr Corrigan invented an instrument for the exhibition of medicated vapours, an account and representation of which is to be found in the *Dublin Medical Journal*, vol. xv. The object of this, as it should be of all similar instruments, is to afford the following facilities for a fair trial of inhalation as a remedial process :—(1) That the apparatus be simple in its construction, and easily kept in order; (2) that it be capable of keeping up a supply of vapour for any length of time, and that the evolution of the vapour be steady and easily regulated; (3) that it furnish sufficient supply of aqueous vapour, to prevent any irritation of the larynx or lining membrane of the tubes; (4) and most important of all, that its employment should entail neither trouble nor fatigue on the invalid.

A method of applying solid medicinal substances to the larynx is sometimes used under the term *insufflation*. The substance to be employed is first reduced to an impalpable powder, it is then placed in a tube, one end of which is carried to the back of the mouth, when, by means of a forcible inspiration, a part of its contents is drawn into the larynx. Fluid applications are sometimes introduced into the larynx by means of the *probang*, and sometimes they are inhaled in the form of spray, the fluids being reduced (*pulverised* or *atomised*, as it is called) by instruments invented for the purpose. The latter plan is frequently used for the inhalation of substances that cannot be readily volatilised.

2. *The Genito-Urinary Tract of Mucous Membrane.*—Medicines are applied to this membrane only for local purposes, and either in the solid or liquid form, as of medicated bougies, caustics, pessaries, and injections. The urethra, bladder, vagina, and uterus are each occasionally treated locally by these means, but in the latter case *only with extreme caution*. *Injections* are *internal lotions* introduced by means of a syringe into certain canals or cavities of the body, whether natural or the result of disease. They consist of water or other fluid holding medicinal substances in solution or suspension. The contents of the injection will depend upon the object to be attained ; they may be used as astringents or emollients, as irritants or sedatives.

Skin.—Medicines are not absorbed so rapidly by the skin as by mucous membranes. The rate of absorption depends, *cæteris paribus*, upon the delicacy of the tissue. The horny skin of the palms of working men, for example, would scarcely absorb at all, whilst between this and the denuded cutis the power of absorption is variously modified. The question of the capability of the skin to absorb medicinal substances from their solution in baths, though fully admitted by the ancients, has been discussed, from time to time, since the close of last century. At that time Abernethy and Falkner concluded, from experiments, that absorption did take place ; and following them, on the affirmative side, were *Braconnot*, *Madden*, *Homolle*, *O. Henri*, *Chevallier* and *Petit*, *Heidler*, and others. Of an opposite opinion were *Seguin*, *Currie*, *Lehmann*, *Kletzinsky*, *Duriau*, *Thomson*, and others. But it is now generally agreed that medicinal substances in a bath are only absorbed to a very trifling amount not sufficient to produce any physiological effect, their action being purely local, *i.e.*, on the skin. Medicines are applied to the skin either for local or remote purposes ; but in order to produce the latter, they must either be absorbed, or act by counter-irritation. As the cuticle impedes absorption, it is often removed to facilitate the process. The methods of applying medicines to the skin are three :—

1. *The Enepidermic Method.*—By this process, as the term implies, the medicine is simply placed upon the epidermis. Poultices, fomentations, lotions, baths, plasters, blisters, &c., are applied enepidermically.

2. *The Iatraleptic Method.*—This process requires more than mere apposition ; the term signifies *to cure by anointing* (ἰατρεύω and ἀλείφω). It has also been called the *epidermic method*, *anatripsologia* (ἀνατρίβω, *to rub in*), and *espnoic medicine.* By this method the medicine is rubbed into the skin, as in the application of ointments and liniments, and for this purpose the best vehicle is chloroform or equal parts of chloroform and alcohol. Other substances may be used as vehicles for the active medicinal ingredient, and some writers have recommended the *gastric juice*, *saliva*, and *bile* for this purpose.

3. *The Endermic or Emplastro-endermic Method.*—In this process the epidermis is removed, and the medicine is applied directly to the true skin. Absorption takes place much more rapidly under this than under either of the previous methods. A blistering plaster, or a vesicating ointment or liniment, may be used to raise the cuticle, which may be either removed or simply opened to let out the serum and admit the medicine. Small quantities of the more active medicines are usually applied to the cutis thus exposed, such as strychnina, aconitina, tartar emetic, &c., but extracts, impalpable powders, &c., have also been used, which, however, must be readily soluble, or they cannot be absorbed. The objections to this method are chiefly the pain of the blistering, and, in exposed parts, the disfigurement caused by it ; but it is often of great advantage in cases in which the stomach, from causes already related, cannot be employed, or in the case of a purely local disorder.

Except when the epidermis is raised, and the medicine is directly applied to the *cutis vera*, the operation of medicines introduced by the skin is often tardy and uncertain. The dose of a medicine to be administered by the skin is generally larger than it would be by the stomach—sometimes two or three times more, sometimes six, eight, ten, or even more. There is no rule for regulating the doses thus given ; but a safe plan, when we have not had experience of the effects by previous trial, is not to apply more than would be safe if the whole were taken into the system, especially if the medicine be applied *endermically.* Œsterlin suggested the following relative proportions as doses to be applied to the different parts of the body :—By the stomach, 1 ; by the unbroken skin, 3 to 6 ; by the endermic application, 1 to 3 ; by ulcers and suppurating sores, 2 to 4. Medicines have also been introduced into the system by *inoculation*, but the practice never became common.

The Hypodermic Method.—The injection of medicines into the cellular tissue, by means of a small graduated syringe, with trochar and canula, or with a finely-pointed tubular needle, is practised successfully for the topical application of remedies, as in certain cases of neuralgia. This method is exceedingly prompt, and the effects of the medicines so introduced are often, generally as well as topically, more powerful than when administered by the mouth. It requires consequently, in the case of a very active medicine, such as atropine, that the dose be considerably less than if it were given by the mouth. Its value is now recognised in the Pharmacopœia, which supplies a formula for a hypodermic injection of morphia. But many other substances are used in this way. Care should also be taken to avoid the neighbourhood of a large vein or artery, in the one case, lest harm result from the medicinal substance being suddenly mixed with the circulating fluid; in the other, lest there be troublesome bleeding. In some cases, injurious suppuration of the subcutaneous cellular tissue results even when the substances injected are not of an irritating nature.

Serous Membranes.—Medicines are applied in certain circumstances to serous membranes, but only for local purposes. The most common instance of this is the injection of irritating substances into the *Tunica vaginalis* for the radical cure of hydrocele. With a similar object, strong solutions have been injected into the peritoneal sac, for the cure of ascites; and into the sac of the pericardium, for the relief of pericarditis with effusion; but although this practice has in several instances been attended with success, it is fraught with danger.

Wounds.—Whether the result of accident or the gradual effect of disease, as ulcers and abscesses, these lesions have been made the seat of medicinal treatment. Commonly, the object of applying medicines to abraded or ulcerated surfaces is to effect their cure; but sometimes they have been taken advantage of to produce constitutional effects.

Veins.—Medicines act most rapidly when plunged at once into the circulation by means of an open vein. This process has been adopted at intervals for several centuries—now vaunted, now decried. It is unquestionably a dangerous practice, and ought to be resorted to only in last extremities. The dangers are chiefly three: the introduction of air into the vein during the operation proving immediately fatal: poisoning by administering, under the circumstances, too large a dose; and subsequent phlebitis. But this method has in several instances proved successful. It has been serviceable in cases of threatened asphyxia, arising from the impaction of a solid substance in the œsophagus, by which the ordinary method of exhibiting a remedy was prevented. Köhler injected six grains of tartar emetic into a vein of the arm of a soldier: vomiting ensued, by which a piece of beef tendon was ejected from his œsophagus, and the man was thus relieved from threatening asphyxia. In other cases of threatening asphyxia, in narcotic poisoning, in the collapse of cholera, in tetanus, hydrophobia, &c., the injection of water, saline solutions, and other remedies have been resorted to.

Transfusion of Blood.—The transfusion of blood by connecting the venous circulation of two individuals has been resorted to with comparative frequency; but, like many other practices attended with danger, it has been from time to time prohibited by general disapproval. After being long in disuse, it was restored by Dr Blundel nearly half a century ago. Transfusion has been chiefly used in cases of exhaustion from hæmorrhage occurring to women in the puerperal state; it has been resorted to also in hæmorrhage from other causes—in anæmia, in epilepsy, in cases in which nutrition is interfered with by organic disease, in debility from profuse discharges, &c.; but it is in hæmorrhagic cases that it has proved most successful. The chief dangers attending the operation are the *admission of air into the veins*, and the *coagulation of the blood* in its passage from one vein to the other. Dr Blundel's transfusion syringe is intended to obviate these risks.

Besides the methods already enumerated, by which medicines may be applied to the human frame, there are others also which we cannot dwell upon. There is, for example, a class of *psychical* or *mental remedial* agencies, which is of the utmost importance in the treatment of disease. The moral and intellectual affections of the mind demand the physician's attention; when violent, they may be subdued, when feebly exercised and when perverted, be restored to their proper functions. The mind may also be affected by external agencies applied to the senses: thus, the eye may contribute attractive scenery, the ear harmonious sounds, the nose and mouth the gratifications afforded by pleasant odours and tastes, and the sense of touch the soothing influence of gentle friction. Again, modifications of diet, exercise, sleep, clothing, and all that we comprehend under the term change of climate, from another class of what are known as *hygienic* remedies, which, although they are too extensive to admit of a place in the *Note-Book*, are nevertheless of the highest importance.

5. Circumstances which modify the Actions of Medicines. —These circumstances may be divided into two classes:—A. Those which relate to the medicine. B. Those which relate to the patient.

A. *Circumstances on the part of the Medicine.*—We have already seen that climate, soil, cultivation, and the manner of collecting, preserving, and preparing them, exercise modifying influences upon medicinal substances, especially those obtained from the vegetable and animal kingdoms. Other circumstances, also pertaining to the medicines, affect their action.

1. *The Dose.*—The action of a medicine differs both in kind and degree, according to the quantity administered. In a certain dose a substance may act as a tonic, in a larger as a corrosive irritant; another substance may act as a sedative in a small dose, and as an emetic and indirect stimulant in a larger dose. In small doses medicines usually act slowly, and produce permanent effects when continued for a length of time ; in larger doses they act promptly, and are commonly given for temporary purposes.

2. *The Physical Condition of the Medicine.*—The state of *aggregation* of a medicine modifies its effects, both in kind and degree. Medicines act most promptly when minutely divided, as in *solution* and *vapour.* All substances to be absorbed must be either exhibited in a state of solution, or be capable of solution in the secretions of the parts to which they are applied. Many medicines which act promptly and energetically when given in solution, scarcely act at all when given in the solid form ; hence the importance of choosing a suitable galenical preparation according to circumstances. The more finely a medicine is divided the less prominent will be its topical, and the more powerful its general, effects. The substances with which medicines are *mechanically* combined also modify their action. They may interpose an impediment to their contact with absorbent membranes, as when arsenic is mixed with finely-divided charcoal, or when medicines become mixed with food after a meal. Under such circumstances substances, which would otherwise have produced powerful effects, are sometimes removed from the alimentary canal, either by regurgitation or by purging, without having caused any serious results. When active principles alone are given, their action often differs from that which follows the adminstration of the entire substance from which they are obtained; thus quinine, although an elegant form of medicine, is not always an efficient representative of bark, nor morphia of opium.

3. *The Chemical Condition of the Medicine.*—Medicines which act energetically in one form of chemical combination may differ both in kind and degree, as to their action, in other chemical relations. Those which evince a powerful local or topical action are essentialy modified by chemical combination, as may be observed in the case of an acid or an alkali; when given separately their action may be powerful, even hazardous, but when combined their effect may be scarcely

perceptible. On the other hand, when medicines act by absorption into the circulation, their effects are not modified to the same extent by this circumstance ; for there are many medicines—such as morphia, strychnia, arsenic, and others—which produce their characteristic results more or less energetically, in whatever chemical form they may be administered. In reference to this modifying effect with respect to poisons, Dr Christison has laid down *two general laws :*— 1. *That poisons which only act locally have their action much impaired or even neutralised in their chemical combinations.* 2. *That the action of poisons which operate by entering the blood, although it may be somewhat lessened, cannot be destroyed or altered in the chemical combinations.*

B. *Circumstances on the part of the Patient.* (*a*) *Physical Causes.* (*b*) *Mental Causes.*

a. Physical Causes.—α. Original Conformation, Symmetrical Peculiarity, Constitution, Idiosyncrasy.—As no two individuals are alike in these things, so no two are subject alike to the actions of medicines. Many illustrations might be given in support of this dogma did space allow. Experience alone can determine these peculiarities; we cannot predicate the effect of an untried medicine, except upon very general and vague principles. We cannot foretell, for example, except by experience, as from ancestral or personal history, that a dose of calomel that might be given with advantage to one person will produce salivation in another ; that a dose of opium given to soothe will result in delirium, or perhaps produce no effect whatever. The general tendency of *Idiosyncrasy* is to increase the activity of medicines, and even to render injurious things commonly pleasant and innocuous, as in the instance of perfumes, which to some are agreeable, to others overpowering. Many articles of food, shell-fish as an example, which are partaken of freely by some, are poisonous to others. Idiosyncrasy sometimes, however, assumes an opposite character, of enabling the individual to take noxious substances with impunity. This is not to be confounded with *Habit.*

β. Habit tends to lessen the action of medicines. Some individuals can take as much opium, arsenic, corrosive sublimate, alcohol, &c., in one day as would poison several unaccustomed persons. The statements respecting arsenic eaters and corrosive-sublimate eaters have been accepted with hesitation, but of opium eaters we have unfortunately only too many examples, and of habitual drunkards still more. With respect to the influence of habits on the actions of poisons, Dr Christison states :—*On the whole, it would appear that more change is effected by habit in the action of the organic than in that of the inorganic poisons ; and that of the former, those which act on the brain and* *nervous system and produce "narcotism," are altered in the most eminent degree. Bouchardat* has stated that habit will not exempt individuals from the effects of those substances which act as poisons to every member of the organic world; but that exemption may be purchased by habit from the effects of those substances which, although generally poisonous, spare certain classes of organised beings. The *general habits* of the patient, his profession, business, or occupation, his diet, and other circumstances connected with his daily pursuits, influence the actions of medicines; and there are certain indications of treatment in the cases of the rich and the poor, the spare and the plethoric, the man of active and the man of sedentary habits, which are far more easily learned from careful clinical observation than from volumes of literature. The habitual use of cathartics, and especially of that class of enemata, often leads to deplorable results, against which patients cannot be too urgently cautioned.

γ. *Age.*—Anatomical and physiological circumstances both modify the actions of medicines relative to age, and to a limited extent the influence of age is analogous to that of *stature;* for in children and little adults the medicine has a smaller range of surface to act upon. But this is almost unimportant when compared with the intense susceptibility of children, especially infants, as compared with adults; their nervous system is so readily excitable, that many substances in doses that would scarcely affect an adult, would excite a child perhaps to convulsions. Aged persons also are more susceptible of the action of certain medicines than adults. Depressing medicines, as evacuants, whether external or internal, are to be used very sparingly at extreme ages; children and old people bear them badly. Children do not bear opiates, but they are not affected constitutionally in the same manner as the adult by comparatively large doses of calomel. No fixed rule can be laid down to determine the doses at certain ages, because the effects of all medicines are not the same at any given age—take opium and calomel as examples. But there is an approximation to a general rule, and it assumes this character, that the dose increases in quantity from birth to the prime of life, reaching its maximum about fifty, and then gradually declines as age advances. The posological tables of Gaubius, Young, and Hufeland are as follows. Gaubius, fixing the dose for an adult as unity, gives the following proportions at different ages:—

Under 1 year,	$\frac{1}{15}$ to $\frac{1}{12}$	Seven years old,	$\frac{1}{3}$
Two years old, . .	$\frac{1}{8}$	Fourteen ,,	$\frac{1}{2}$
Three ,, . .	$\frac{1}{6}$	Twenty ,,	$\frac{2}{3}$
Four ,, . .	$\frac{1}{4}$	Twenty to sixty	1

Dr Young's rule is, that for children under twelve years the adult doses of most medicines must be diminished in the proportion of the age to the age increased by twelve; or in other words add twelve years to the age of the child, and divide the real age by the sum, thus:—

Child's age / Add 12 $\frac{1}{1+12}=\frac{1}{13}$ $\frac{2}{2+12}=\frac{1}{7}$ $\frac{3}{3+12}=\frac{1}{5}$ $\frac{4}{4+12}=\frac{1}{4}$

Hufeland gives the following proportionate doses for different ages, fixing the adult or maximum dose between the years twenty-five and fifty:—

½ to 1 month	½ to 2 parts.	3 to 4 years	16 to 18 parts.
1 ,, 2 months	2 ,, 4 ,,	4 ,, 5 ,,	18 ,, 20 ,,
2 ,, 3 ,,	4 ,, 5 ,,	5 ,, 10 ,,	20 ,, 25 ,,
3 ,, 4 ,,	5 ,, 6 ,,	10 ,, 20 ,,	25 ,, 35 ,,
5 ,, 7 ,,	6 ,, 7 ,,	20 ,, 25 ,,	35 ,, 40 ,,
7 ,, 9 ,,	7 ,, 8 ,,	25 ,, 50 ,,	40 ,, — ,,
9 ,, 11 ,,	8 ,, 9 ,,	50 ,, 70 ,,	40 ,, 30 ,,
1 ,, 2 years	10 ,, 13 ,,	70 ,, 80 ,,	30 ,, 25 ,,
2 ,, 3 ,,	13 ,, 16 ,,		

δ. *Sex.*—In childhood there is little difference between the sexes as to the actions of medicines; but in adult life the difference of functional activity exercises a modifying influence. Menstruation, pregnancy, and lactation are circumstances in the female demanding anxious consideration in the administration of medicines. Females are generally more susceptible of medicinal action than males—a rule like the rest, however, which has many exceptions. During lactation, it is to be remembered that medicines given to the mother affect the child.

ε. *Disease.*—The nature and intensity of disease exercises a remarkable influence upon the action of medicines. We have examples of this in the inefficiency of enormous doses of opium in tetanus, and of mercurials in fever. Medicines requiring alkaline secretions to dissolve them will not act when the bile is retained, as in jaundice.

ξ. *Organs and Tissues.*—The action of a medicine is modified, both in kind and degree, according to the nature of the organ or tissue to which it is applied. This modification arises from two causes—the relative absorbent power, and the properties of the secretion of the part. The skin, mucous membranes, serous membranes, wounds, and open veins are the several channels by which medicines may be introduced into the system, and they are here enumerated according to their relative absorbent powers—from the skin, which is least active, to the open vein, which is the direct intrusion of the medicine into the circulation. The modifying influence of *organs* depends, in part, upon the properties of their tissues, but also on their relative sympathetic relations to other organs, and their importance to vitality.

η. *Climate.*—In estimating the value of climate as a modifying cause in the actions of medicines, it is to be remembered that the influence may be exercised upon the drug as well as upon the patient. A plant which yields active medicinal substances in one country, may be medicinally inert, though physically even more luxuriant, when grown in another, an influence which has already been adverted to. We have now to consider the effects of climate upon the patient—the medicine remaining the same. There is much in the *habits* of people of different nations, constituting *national character*, that is to be considered in the word *climate*, for we can scarcely dissociate the elements of daily existence, and allot to temperature, moisture, barometric pressure, and actinic force, such and such portions of the modifying influence. That climate, in this wide sense, does exercise a powerful influence upon the actions of medicines is scarcely to be doubted; but so complex is the question, and so intricately interwoven with the multifarious operations of the animal economy, that it is really very difficult to meet with unexceptionable proofs of its action. The following are among the instances quoted by Dr Paris and other writers as indications of the effects of climate. The inhabitants of Rome are peculiarly affected by the odour of flowers, in some cases amounting even to syncope. Dr Richard Harrison, in a communication to Dr Paris, stated, as his experience, that narcotics act with greater force, even in smaller doses, at Naples than in England. Extract of Hyoscyamus, given in three-grain doses thrice a day, produced temporary amaurosis in ten patients; and this effect was reproduced by a second exhibition of the medicine, although the same patients had been in the habit of taking the medicine in England without any unpleasant result. The same writer states that he had successfully treated several cases of epilepsy in Italy with nitrate of silver, while in England he had not met with the same good results. Mercurials are also more active in Italy than in this country. But mercurials are sometimes given in much larger doses in warmer climates than in our own country: in India, the West Indies, and many other countries, this class of remedies is sometimes administered in what we should consider enormous doses; not, however, for the purpose of producing constitutional effects, for which, indeed, they are but sparingly used. In his *Diseases of Bengal*, Dr Twining states that depletion by blood-letting, purgatives, mercurials, jalap, castor oil, &c., are used more sparingly with the natives than with the resident Europeans. Lascar sailors, it is said, require much smaller doses than Europeans. Persons who have recently changed their residence from one climate to another do not bear the doses usually given at their new residence at once, though the system soon accommodates itself to its altered circumstances. Albers states that Englishmen residing in Bonn are compelled to reduce the doses of medicines which they were accustomed to at home. Dr Lombard, of Geneva, makes the same remark in regard to Englishmen residing in Switzerland. The state of the weather, the season of the year, and the time of day are also supposed to exercise an influence upon the action of medicines. Dr Annesley states that the subsidiary fever of Nagpore is cured by cinchona bark in the cold season, but that this remedy fails in the rainy season, when it is replaced by calomel and antimony. The prevalence of epidemics is also a modifying cause.

b. Mental Causes.—The intimate relation of the mind and body is such that physical suffering can scarcely be associated with a calm and passionless mind. In every case of sickness one or other of the mental emotions is aroused, and this the physician has to cherish or subdue according to the necessities of his patient. *Depressing* emotions are seldom favourable to recovery, and when they are predominant, it is our duty to awaken the patient to a feeling of hope, faith, and gladness, in order that the remedies applied may be seconded by that measure of *willingness* to *recover*, without which even the most potent medicines will prove ineffectual. There is, above all, one feeling with which it is absolutely essential that the physician should inspire his patient, that of *faith*, not only in the efficacy of the means employed but in his own integrity, uprightness, and Christian conduct, an emotion which no personal advantages, however great, should induce him to forego. Diseases complicated with derangment of the intellectual faculties, and with nervous affections such as hysteria, especially demand attention to what may be termed *physical* therapeutics. Perhaps the most trying cases that a physician has to deal with are those suffering from long-protracted, ultimately hopeless, sometimes very painful diseases, which, whilst they demand his anxious care, afford little or no opportunity of displaying his skill. Perhaps he may feel humiliated, and would rather be without such patients. But no, he has one all-important duty yet to fulfil: his patient is daily craving for some new interference, for something that might surely still be done; but when, after due consultation, it is finally determined that further active interference would be unwise, then it is his duty to protect his patient from unprincipled quacks, who endeavour by their disgusting advertisements to attract the attention of such helpless patients or their friends, that they may increase by them their dishonest gains. Then it is that, by a careful balancing of the passions, inspiring no vain hope, whilst he dispels too anxious fears, the Christian physician may soothe the last days of his patient, pointing to that Great Physician in whose presence there is everlasting joy. Then, too, may the patient say—

> "Let Fear, that watchful guard within,
> Defend my soul from mental sin;
> Let Hope her radiant charms display,
> Dispel all doubts, and speed my way.
> Let hate her keenest shafts employ,
> Pride, Lust, and Envy to destroy;
> Let no vile thought pollute my frame,
> But love divine my soul inflame.
> Thus every passion kindly given,
> Shall smooth the path that leads to Heaven."

6. **The Prescription.**—We have already said that the physician's prescription occupies the very centre of the medical sciences, that it is the practical application of these sciences to the cure of disease. But in this wide sense the word is to be understood as synonymous with the terms *general instruction or direction*. A physician may cure certain patients without the aid of pharmacological remedies, by instructing them in, or directing them to pursue, a certain course of *hygienic* treatment. That, however, is not the sense in which we now use the word: we are to consider it as a *formula* chiefly intended to guide the druggist in the preparation of suitable pharmacological remedies. Prescriptions written by the physician to suit occasions are called *magistral*, because written by a master of his profession, or *extemporaneous*, because written without previous preparation—*ex tempore*.

To prescribe well is no easy matter. Independently of scientific and practical therapeutical knowledge, it demands an acquaintance with the practical details of pharmacy, which, in its turn, involves the laws of natural history, chemistry, and physics. The opportunity of studying practical pharmacy in a private laboratory, in the shop of a pharmaceutical chemist, or at a public hospital or dispensary, should never be neglected by the student of medicine. The knowledge thus acquired will prove to be of the utmost value in after-life; and it must be deeply regretted that so little has been done in this country for the encouragement of *Schools of Pharmacy*.

To write a prescription may appear to be a comparatively trivial matter, and often enough it is not until the student has become the practitioner that he is undeceived. Then he finds that there is a great difference between merely repeating a prescription from memory and devising and constructing one to suit a special emergency. Prescriptions are written either partly or wholly in *Latin* or in the *vernacular* language, the latter being used in France, the former more or less in Great Britain. Formerly the three Pharmacopœias of this country were written in Latin, but the later editions of the Edinburgh and Dublin Pharmacopœias, and the British Pharmacopœia, are in English. The *Latin* and *vernacular* have both been advocated, and it is still a matter of dispute as to which is the most appropriate. It appears to be generally admitted, however, that the names of the ingredients should be written in Latin, chiefly for the following reasons :—(1) Because the Latin name of a drug is more definite, usually the same in different countries, and is not rendered unintelligible by moderate contraction; (2) because the prescription can then be prepared by dispensers in foreign countries, as well as by those at home ; and (3) because it is sometimes necessary to keep the patient in ignorance of what he is taking—a matter of much greater difficulty, however, since the introduction of scientific nomenclature into popular language. The reasons urged against the use of any but the vernacular language are chiefly the fear of mistakes occurring, either in consequence of the doubtful Latin of the prescription, or the ignorance of the dispenser, and that *Medical Latin*, being unlike the classical Latin, is not always intelligible, even to persons of liberal education. The common practice in prescribing, however, is to write in Latin that part of the prescription which is only for the instruction of the dispenser, and to employ the vernacular in the parts common to the dispenser and the patient.

The prescription is generally arranged in the following order :—

1. *The Heading of the Prescription* (*the præpositio, or superscription*). —This is used merely to arrest the attention of the dispenser; but it materially affects the grammatical construction of the prescription. It consists simply of the letter ℞. The origin of the practice of thus beginning a prescription is to be found in the ancient and popular belief in the sideral influences, the letter being in truth but a modification of the astrological symbol of the planet Jupiter. In early times prescriptions invariably began by a pious or superstitious reference to some controlling power. The expressions J. D. (*juvante Deo*), N. D. (*Nomine Dei*), J. J. (*juvante Jesu*), and the characters + and α ω, the sign of the cross, and the *alpha* and *omega* of the Greek alphabet, with reference to the Saviour, were in common use, and were termed the *invocation* or *inscription*. The letter is now, however, understood to be the initial of the word *recipe*, *take*, synonymous with the French prescription P. *prenez*. When this prescription is used, the Latin names of the ingredients following it are put in the *genitive* case and the quantities of each in the *accusative*. Thus, ℞, *Liquoris Ammoniæ Acetatis*, *drachmas duas*, signifies, Take two drachms of the solution

of Acetate of Ammonia. When the prescription is written in English the superscription is "Take of,"—the sign of the genitive case, which is applicable to all the ingredients, being put in the superscription once for all.

2. *The ingredients that are to be introduced into the medicine* (*Materiæ designatio, the Inscription*).—The name of each ingredient, usually written in *Latin*, occupies a single line. The ingredients are arranged in one of two ways—either according to their therapeutical value, or according to the order in which the dispenser will find it most convenient to use them. The latter method is not essential, however, because it is the duty of the dispenser to carry out the intention of the physician by the most appropriate pharmaceutical method; but it is an evidence of superior attainments when the physician can attend both to the therapeutics and the accurate pharmaceutical details of his prescription.

In the selection of the pharmacological remedies to be employed, the physician is guided by the peculiarities of his patient, and the character of the disease to be treated. The circumstances which modify the actions of medicines are to be taken into consideration in conjunction with the history and present stage of the malady, and the general and special conditions of the patient. Having ascertained these points, *Materia Medica* is divisible into two parts, the one containing substances that may be used, the other those which obviously cannot be used in the treatment—or, in other words, into medicines that are *indicated*, and those that are *contra-indicated*.

Treatment will vary according to such circumstances as the nature of the disease, the constitution of the patient, and the judgment of the practitioner; but there are a few cardinal rules that never alter, one or two of which I will mention. Never employ powerful medicines when others of a milder kind will answer the purpose: the more of a man's estate that remains after a lawsuit, the greater is the credit due to his legal adviser, and the more constitutional strength the patient has at the close of his illness the more grateful will he be to his physician. Never select a medicine, or administer one in such a manner that, although the disease may disappear during its exhibition, it may be said of its ultimate and permanent effects, that they are as bad as, or worse than the disease itself. When a plan of treatment has been resolved upon, do not impatiently break through it by frequently changing the medicine, in a vain attempt to combat every symptom; and do not cherish the idea that every improvement in the patient's condition is necessarily due to the medicine, and that every change for the worse is attributable to the disease; this is often a very difficult question to determine, and one which requires the nicest discrimination. Always bear in mind the state in which the patient will probably be in the next, or any subsequent stage of the disease, and endeavour as much as possible to protect him from treatment that would then militate against him. Always divide the responsibility, by consultation with an experienced brother, before pursuing a course of treatment by which the life of the patient may be placed in jeopardy. Next to his health, be careful of the patient's pocket; never hesitate to recommend that which is *essential*, however costly, but do not thoughtlessly spend his money upon expensive medicines or mechanical appliances of questionable utility.

The tendency of the practice of the present day is decidedly towards *simplicity* rather than *complexity* in prescriptions. We seldom now meet with the curious mixtures that were formerly so common, in which it would seem that the practitioners had united as many ingredients as possible, in the blind hope that one or other of them might hit the mark and cure the disease. But whilst *polypharmacy* is doubtless an evil when uncontrolled by science and reason, we may possibly, by refining too much, fall into an opposite error. Organic chemistry has conferred a great boon upon the physician by discovering and separating many of the powerful constituents of medicinal plants; but experience has shown that these elegant preparations are not always efficient substitutes for the plants themselves. Nor are simple prescriptions always preferable to those which contain two or more ingredients; for, by a judicious combination of medicines, results may be obtained which cannot be derived from individual remedies. What the physician has chiefly to guard against in the construction of a compound prescription, is the admission of substances, the object of whose presence he cannot explain. If there be four ingredients in a prescription, and the prescriber can only explain his intentions with respect to three of them, the fourth should be omitted, as it can only be there on chance. If we were restricted to the use of those drugs alone whose *modus operandi* can be clearly explained, we should at once be cut off from many of the most valuable remedies of the *Materia Medica*, the use of which rests upon no higher authority than the sanction of experience, and many of the valuable compound official formulæ by the same terms would be swept away. But it is not essential to the construction of a compound prescription that the practitioner be able to foretell infallibly the results to be produced by it, nor even that he be able to explain the *modus operandi* of all or any of the ingredients; it is sufficient if he can account for the presence of each constituent of the prescription upon some philosophical principle, or plan of treatment. If there be anything present that cannot be thus explained, the prescription would be better without it.

The object of the physician when prescribing should be—in the words of Asclepiades—*curare cito, tuto et jucunde*, and with this in view, the compound prescription is often, though by no means invariably or essentially, divided into four parts, namely—(1) *the Basis* (the active *curative* principle—*curare*); (2) *the Adjuvant* (*Adjuvans*, an auxiliary, to make the basis act energetically and *quickly—cito*); (3) *the* Corrective (*Corrigens*, to cause the active ingredients to operate *safely—tuto*); and (4) *the Vehicle*, or *Excipient* (*Vehiculum, Excipiens, Constituens*), to give a suitable form, and to render the medicine *pleasant—jucunde*).

The prescriber who can judiciously combine two or more medicines has always more resources at command than one who knows only how to administer single remedies, or is confined to the compound official formulæ, or who, in his attempts at extemporaneous combination, fails to produce a useful or suitable medicine. The points to be held in remembrance in prescribing are chiefly those in relation to the therapeutical action of the remedies, their chemical behaviour both before and after admission into the system, and their physical condition.

Therapeutically, medicines may be rendered more active, either by combining two or more forms of the same substances; by adding to the basis of the prescription an adjuvant derived from the same substance, but having a similar action, which is intensified by the combination; or by uniting a basis and an adjuvant derived from substances which, when given separately, do not produce a corresponding effect. The therapeutical effects of medicines may be obtained in some cases more fully by the addition of substances by which the untoward effects of the active ingredients are corrected, and without which the latter ingredients would either not be tolerated by the system, or would produce other effects. The ultimate and desired therapeutical effect of a prescription may also be attained by the combination of remedies which, though capable of producing identical effects when administered separately, attain their object by a different mode of action. And sometimes medicines are united which have separate and distinct indications to fulfil. All these forms of combination may be employed without necessarily inducing any obvious chemical changes.

Chemically, the object of the prescriber is to combine ingredients which either do not alter their original conditions when united in the same compound, or which act upon each other in such a way as to cause the disappearance of the original substances and the formation of a new and suitable compound. When two or more substances can be united without changing their chemical properties, they are said to be *compatible;* but when their combination gives rise to chemical changes, the substances are said to be *incompatible.* But these terms are to be understood as having merely a chemical significance, and not as precluding such combinations for therapeutical purposes, provided these changes do not interfere with the desired action of the ingredients. There are many instances amongst the official formulæ of compounds which do not represent the properties of their constituents. It is only when the prescriber unites substances capable of reacting chemically upon each other in such a manner as to cause changes of which he is ignorant, that he runs a risk of producing a compound which may be either dangerous or simply inefficacious as a medicine, according to circumstances. When chemical decomposition takes place amongst the ingredients of a prescription, the result may be one of four things:—(1) That the prescription is dangerous, and unfit for use in the quantities prescribed; (2) that it is rendered medicinally inert; (3) that a new compound may have arisen with properties similar but more powerful, similar but less powerful, or altogether different from those of the original ingredients; and (4) that a new compound may be produced which, though not presenting the desired properties before administration, may be so modified by the secretions of the alimentary canal as to become a convenient and suitable remedy.

Physically, the object of the prescriber is to produce a medicine suited both to the necessities and feelings of the patient. A medicine which, by its appearance, odour, or taste, is more than usually disagreeable, will probably frustrate the object of the prescriber, by creating an aversion and dread of it in the mind of the patient. The ingredients of a prescription may be *pharmaceutically,* or mechanically as well as *chemically, incompatible;* thus, when spirit of nitrous ether and tincture of guaiacum are combined, the result is a gelatinous mass unfit for use. Many of the resinous substances are precipitated from their spirituous solutions on the addition of water, and, therefore, when the ingredients are brought together, a mucilaginous substance is required to form a suitable mixture. This matter has already been adverted to in the section devoted to official formulæ.

Medicines may also be physiologically incompatible, that is, their actions may be antagonistic to a greater or less extent, as aconite and digitalis, strychnine, and chloral, &c., which, if administered together, the action of the one would be neutralised to a certain extent by the action of the other according to the dose.

The quantities of the several ingredients of the prescription are to be represented by certain characters, which have already been described with the weights and measures used in pharmacy. The quantity is placed at the end of each line opposite to the ingredient to which it refers, except in prescriptions where two or more consecutive ingredients are ordered in equal proportions, when the quantity is written only opposite to the last of them, being preceded by the united letters *āā* (ἀνὰ) signifying "of each" *so much.*

When medicines are prescribed in forms in which the doses are divided into separate parts, as pills, powders, draughts, &c., the prescriber may either write the quantities sufficient for one dose, directing the dispenser to send two, four, six, a dozen or more of such; or he may combine the quantities, and direct the dispenser to divide the whole into *so many* pills, powders, &c. Perhaps the former plan is more conducive to careful prescribing, but the latter will, in either case, be adopted by the dispenser.

The *doses* of the ingredients will vary according to circumstances, some of which have already been referred to under the head of *modifying causes.* The prescriber will also consider the following points: —Medicines that are to act promptly, and to fulfil a temporary indication, are usually given in full doses, whilst those which are given to produce constitutional and permanent effects are given in small and generally in gradually increasing doses. Some medicines diminish in activity in proportion to the duration of their exhibition, whilst others increase in activity the longer they are given. In the former case the dose is to be gradually increased, and in the latter gradually diminished. Some medicines are said to *accumulate* in the system; their action is sometimes suddenly manifested in an alarming manner, and does not subside, but, on the contrary, often increases, for some time after the patient has ceased to take them. This, however, only occurs if the dose given has been too large or too frequent, and is not due to any peculiarity in the action of the medicine. Medicines with this tendency require extreme caution and watchfulness during their exhibition. Great care is to be observed also in the administration of powerful medicines when the prescription is prepared from a fresh stock of the active ingredient. When a druggist begins a new stock of a powerful remedy, apt to spoil by keeping, he should caution the physician, whose patient has been taking the medicine in increasing doses from the old stock, the probability being, that the new will be much stronger than the old. In such cases it is safer to reduce the dose so as to meet the probable difference. The physiological and therapeutical actions of medicines differ according to the doses in which they are given; thus tartar emetic in small doses acts as a diaphoretic and expectorant, but in larger doses as an emetic. But if it be given in gradually increasing doses, it does not produce emesis, but acts in the larger doses as a contra-stimulant. This method of exhibiting such medicines is sometimes spoken of as *establishing a tolerance.* The interval between the doses varies according to the objects to be attained. When medicines are given for a length of time, with the view of producing gradual and permanent effects, it is important to observe the stated periods of their administration; for it is desirable to maintain a regular chain of effects, which cannot be accomplished if the links are sometimes longer, sometimes shorter, and sometimes omitted altogether. There is one more point of importance, one which is often neglected; it is this, that when a medicine has been administered for a considerable time in gradually increasing doses, it should not, unless unusual circumstances arise, be suddenly stopped, but be gradually diminished in the inverse order of its early administration.

3. *The Directions to the Dispenser* (*Subscriptio, the Subscription*).—These also are generally written in *Latin;* they instruct the dispenser in the manner of preparing the medicine, and as to the form to be given to it. The shortest direction, and a very common one, is the letter M., the initial of the word *Misce,* signifying *Mix (the ingredients).* S., the initial of *Solve* (*dissolve* the solid ingredients in the vehicle), is also frequently used. Then commonly follows Ft., the initial and terminal letters of *fiat* or *fiant, let be made:* thus—(*Ex His*) *Fiat Haustus* (of these ingredients), *let a draught be made; Fiat Mistura, let a mixture be made; Fiant pilulæ viginti, let twenty pills be made.* Or the instructions may be more minute, as in the following instance: —*Tere oleum cum mucilagine donec probè coiverint, tum sensim adde decoctum, ut fiat enema; Rub the oil with the mucilage until they are well combined, then gradually add the decoction, that an enema may be made.*

4. *Instructions to the Patient* (*Signatura, the Signature*).—This part of the prescription is sometimes introduced by the initial letter S., or by the word in full, *Signa* or *Signetur, call it,* or *let it be entitled* (the mixture, the draught, &c.). Then follow the directions that are to be written by the dispenser, for the patient's information, upon the label of the bottle or box. Some physicians still write the signature in Latin, but it would be much better if all would write it in English, for such a rule would greatly diminish the risk of errors. The signature should contain full and plain directions as to the quantity to be

taken at a time, the intervals between the doses, and the mode in which the medicine may be most agreeably or conveniently administered. All powerful remedies to be applied externally should be distinctly labelled POISON, OR FOR EXTERNAL USE ONLY. The new Pharmaceutical Act renders it now imperative upon the dispenser to label all dangerous medicines POISON, whether the physician order it so or not. Patients are seldom provided with graduated measures wherewith to apportion their doses; they commonly use articles employed for domestic purposes. It is necessary, therefore, that the prescriber should be familiar with the relative capacities of pharmaceutical and domestic measures.

A tea-spoonful	is generally	equal to	1 fluid drachm.		
A dessert-spoonful	,,	,,	2	,,	,,
A table-spoonful	,,	,,	4	,,	,,
A wine-glassful	,,	,,	$1\frac{1}{2}$ to 2 fluid ounces.		
A tea-cupful	,,	,,	5	,,	,,
A breakfast-cupful	,,	,,	8	,,	,,
A tumblerful	,,	,,	10 to 12	,,	,,

Sometimes the physician gives verbal directions to the patient himself, and for the signature writes only "To be taken as directed"; but this is not a good or safe rule to adopt, as serious mistakes may result from it. There are, however, cases in which this form of signature is desirable, namely, those in which full directions for the taking of the medicine would betray the nature of the patient's complaint. Most people are extremely sensitive on this point, and it would be as injudicious for the physician to advertise the patient's malady on the label of the medicine bottle as it would be opposed to medical ethics to repeat what he had seen or heard in a patient's house. The physician cannot be too careful to avoid wounding the feelings of his patient.

5. *Name, Date, and Initials.*—The name of the patient is written legibly, and in English, at the foot of the prescription; beneath it is the date, which is sometimes written in Latin, but with no peculiar advantage. Lastly, the physician's initials complete the prescription. The initials should be distinctly written; indeed, it is a question whether it would not be better to write the name in full, so that the dispenser might the more readily recognise the author, and so be able to communicate with him immediately, in case of need. In large cities it must be difficult to recognise the initials of all the physicians; and it is to be remembered that the physician's signature is the only justification for the sale of certain poisonous drugs.

The different parts of the prescription are noted in the following examples:—

1 ℞
2 { Elaterii, granum dimidium . . . (*Basis*).
Hydrargyri Subchloridi . . . . . (*Adjuvans*).
Pulveris Capsici, ana, grana duo . . (*Corrigens*).
Confectionis Rosæ caninæ, quantum sufficiat (*Excipiens*).
3 Fiat Pilula. Signetur.
4 The pill; to be taken to-morrow morning.
Patient's name.
Date. Initials.

The following is the *house medicine* or *black draught* of most hospitals:—

1 ℞
2 { Magnesii Sulphatis, unciam . . . (*Basis*).
Tincturæ Sennæ }
Tincturæ Jalapæ } . . . . . (*Adjuvantia*).
Syrupi Zingiberis, ana fluiddrachmas tres (*Corrigens*).
Infusi Sennæ uncias quinque . . . (*Vehiculum*).
3 Misce, fiat Mistura Aperiens. Signetur.
4 The Aperient Mixture; to be administered in doses of three or four table-spoonfuls.

1. Heading, Præpositio, or Superscription. 2. Ingredients, Materiæ designatio, or Inscription. 3. Directions to the Dispenser, Subscriptio, Subscription. 4. Instructions to the patient, Signatura, Signature.

The same prescriptions abbreviated:—

℞	℞ Mag. Sulph. ℥i.
Elaterii, gr. ss.	Tinct. Sennæ.
Hydrarg. Subchlorid.	Tinct. Jalapæ.
Pulv. Capsici, āā gr. 2.	Syr. Zingib. āā f ʒiij.
Confec. Rosæ can. q. s.	Inf. Sennæ, f ℥v.
Ft. pil. i. Sig. &c.	M. ft. Mist. Aperiens. Sig. &c.

I have here used the old symbols of the ounce, the fluid ounce, and the fluid drachm, but the student will remember that in the British Pharmacopœia these are replaced by the abbreviations *oz.*, *fl. oz.*, and *fl. dr.*

In writing the prescription, the student will bear in mind the following points:—(1) To write distinctly; (2) not to abbreviate the words so as to make them unintelligible to the dispenser, or in any way to cause errors; (3) to be very particular in writing the characters representing the quantities of the ingredients; (4) carefully to revise the prescription on every occasion before parting with it.

PART II.—INORGANIC MATERIA MEDICA.

CLASS I.—METALLOIDS OR NON-METALLIC BODIES.

Group I. Gaseous—Oxygen [Ozone], Hydrogen [Water], Nitrogen, Chlorine and its Compounds.

OXYGEN ($O=16$).

Preparation.—Most commonly by heating together four parts of finely-powdered chlorate of potassium, and one part of well-dried peroxide of manganese ($KClO_3=KCl+O_3$); the peroxide of manganese is used in this process merely because it causes the expulsion of the gas at a much lower temperature than would be required if the chlorate were heated alone.

Characters.—An elementary, permanent, colourless, inodorous, tasteless gas; the chief supporter of combustion and respiration; sp. gr. 1·1057.

Oxygen Water.—Aqua oxygenata seu oxygenii is simply water charged with oxygen by means of a suitable apparatus, the proportion of oxygen contained in the water being generally as one volume of the gas to two of the water. This preparation is not to be confounded with *peroxide of hydrogen*, which was formerly called *oxygenated* or *oxy water.*

OZONE.—When first discovered, was supposed to be a new elementary substance, but was subsequently ascertained to be merely a modification of oxygen. It received its name from its discoverer, Schönbein, who called it ozone, in consequence of its peculiar odour (*ὄζω, I smell*). It is a powerful oxidising agent, is denser than oxygen in the proportion of 3 to 2, is produced when the electric spark is passed through dry air, is contained in electrolytic oxygen, and is formed during the slow oxygenation of various substances in air, as, for instance, of phosphorus, ether, alcohol, or, more particularly, of certain volatile oils, for example, oil of turpentine.

Therapeutics.—Oxygen is essential to the support of vigorous animal and vegetable life; but it cannot be respired in the pure state without causing injurious effects, and ultimately death. In moderate quantity, sufficiently diluted, it gives rise to exhilaration of spirits, accelerates the circulation, and causes slight diaphoresis, effects which are, however, exceedingly transient. Locally it is a stimulant.

Formerly, oxygen enjoyed a considerable therapeutical reputation, but it is now seldom administered. The cases in which it has been most frequently used are those in which pure unvitiated air is obviously indicated, as in asphyxia, whether produced by deprivation of air, or by the inhalation of poisonous vapours; and in chronic pulmonary diseases in which dyspnœa is associated with general debility, as asthma, phthisis, hooping-cough, &c., and its employment in a concentrated form is contra-indicated in a tendency to apoplexy or pulmonary hæmorrhage, hence why patients with weak chests and liable to attacks of pulmonary congestion do not do so well in the higher oxygenated atmospheres. It has also been administered, both internally and topically, in unhealthy wounds, ulcers, gangrene, &c.

Oxygenated water has been given in quantities of one or two bottlefuls daily, as a mild stimulant to the secreting organs. It has been recommended chiefly in cachæmic diseases, with the view of promoting the powers of assimilation and secretion.

The value of *ozone* as a curative and hygienic agent cannot be duly estimated until its properties are more fully recognised; but that it is intimately associated with the health of communities is generally believed. It is, probably in consequence of its oxidising property, a disinfectant. There is abundance of negative evidence of the utility of ozone, such as, that it exists in largest quantity in pure air, more abundantly in the higher than in the lower strata of the atmosphere, much more without than within large cities, and more to windward than to leeward of them. It exists more abundantly in some than in other winds, and when air becomes stagnant it vanishes. Cholera and ozone are said to avoid each other. Ozone has been supposed also to be capable of destroying malaria. Schönbein observed that the quantity of ozone in the atmosphere and the prevalence of malarial diseases bore an inverse relation to one another, and this he found to be the case, not only in point of time, but also in respect of locality, results which have been confirmed by other competent observers. It has been employed in the same cases as those mentioned under oxygen, and also in diphtheria, where its action may be useful by destroying the low organisms which produce the disease.

HYDROGEN ($H=1$).

Preparation.—The readiest method is by the action of zinc upon sulphuric acid in water ($H_2SO_4+Zn=ZnSO_4+H_2$).

Characters.—It is a permanent, neutral, invisible, tasteless, and, when pure, an inodorous gas, but it usually has a peculiar odour, due to the presence of foreign substances. It is the lightest form of matter known, its sp. gr. being 0·0693. It burns in contact with air with a pale-yellowish flame, but does not support combustion, and when mixed with air and ignited it explodes violently. It is very sparingly soluble in water. When quite pure it burns with a colourless flame, which leaves no deposit upon the surface of a porcelain dish; when depressed upon it, showing absence of arsenic and other impurities.

Hydrogenii Peroxydum (or H_2O_2).—Not official. Peroxide of Hydrogen is generally prepared by the action of hydrochloric acid upon peroxide of barium ($BaO_2+2HCl=BaCl_2+H_2O_2$). It is a colourless liquid of syrupy consistence, metallic taste, having a sp. gr. of 1·452. It is soluble in water, is a powerful oxidiser, readily parting with its oxygen, and bleaches the skin and mucous membrane when applied to them undiluted.

Therapeutics.—Hydrogen is not used medicinally in the present day, but was formerly tried in phthisis, &c., without attaining a permanent reputation.

Peroxide of Hydrogen, when properly diluted, acts as a stimulant. When applied to the skin or tongue it causes a prickling sensation; it thickens the saliva; and, when administered freely, has caused profuse salivation. It has of late been strongly recommended in diabetes mellitus. It is employed in heart disease, attended with pulmonary congestion, in hooping-cough, chronic bronchitis, phthisis, struma, &c. Dose, fl. dr. ss. to fl. oz. ss., well diluted in water. The patent disinfectant "Sanitas" is said to depend for its efficacy upon this peroxide.

AQUA.—Water—Natural Water (H_2O) is placed amongst the *Materia Medica* of the pharmacopœia. It is required to be the purest that can be obtained, cleared, if necessary, by filtration, and free from odour, taste, and visible impurity. The chief varieties of fresh-water are rain-water, spring-water, lake-water, river-water, and marsh-water; but as all these varieties contain more or less of impurities, they are unfit for pharmaceutical purposes, for which there is an official distilled water. The subject of the purity and properties of common water belongs rather to hygiene than to pharmacology.

Aqua Destillata.—Distilled water.

Preparation.—*Take of water, free from taste and odour, ten gallons. Distil from a copper still, connected with a block-tin worm, reject the first half gallon, and preserve the next eight gallons.*

Purity Tests.—A fluid ounce of it evaporated in a clean glass capsule leaves scarcely a visible residue, showing the absence generally of fixed impurity. It is not affected by sulphuretted hydrogen, oxalate of ammonia, nitrate of silver, chloride of barium or solution of lime, showing absence generally of fixed impurity, absence of lead, copper, and other metallic impurities. Absence of salts of lime, chlorides, sulphates, and carbonic acid.

Therapeutics.—Natural, plain, or common water is largely used as an article of diet, both alone and as a constituent of solid food and of beverages. Medicinally, it serves, when taken internally, as a diluent, solvent, and occasionally as an evacuant; externally, it acts, according to the temperature at which it is applied, as a detergent, a tonic, a sedative, an emollient, a counter-irritant, &c.; and in the form of *water-dressing* it is of great value as an application to inflamed surfaces, wounds, and ulcers. Water is also largely used for baths, which may be either simple or medicated, local or general. When water alone is used, the effects of the bath will be determined by its temperature and duration. Baths are cold when the temperature of the water is below 60°; cool from 60° to 75°; temperate from 75° to 85°; tepid from 85° to 92°; warm from 92° to 98°; and hot from 98° to 112°. The temperature of the vapour-bath ranges from 112° to 144° Fahrenheit. Distilled water is largely used in most of the pharmaceutical processes requiring water as a menstruum, especially in the preparation of infusions, decoctions, and medicated waters.

AQUÆ MINERALES.—Every variety of natural water contains more or less of foreign substances in solution or suspension, to which it owes its peculiar taste, odour, or appearance, so that every spring that yields a good potable water might with propriety be called a mineral spring. The term *Mineral Water*, however, is usually confined to such as have more carbonic acid or sulphuretted hydrogen, or a greater proportion of salts, or a temperature above the mean heat of their latitude, or the term may be applied to those springs which possess properties in relation to the human body differing from those of ordinary water used as drink, and in this sense comprehend some remarkable for nothing but their purity.

Mineral waters derive their ingredients from the rocks and soil through which they pass in their way to the surface of the earth. They contain, besides, a variety of saline principles, a certain quantity of organic and inorganic substances, together with more or less of a free gas, either sulphuretted hydrogen, carbonic acid, nitrogen, or oxygen. They usually contain in greater or less quantity some or all of the following salts:—The hydrochlorates, sulphates, and carbonates of soda, lime, magnesia, potash, alumina, baryta, strontia, lithia, and manganese. Besides these, there are occasionally found bromine and iodine, and a variety of metallic salts, such as those of iron, copper, arsenic, &c. Some springs contain what has been imperfectly described as a *vegeto-animal* substance, known by the names of *baregine*, *glairine*, or *zoogine*, and another substance called *sulfuraire*. The former of these is amorphous, of gelatinous consistence, and of varying colour, density, and quantity; its constitution and use are but imperfectly understood, but it is supposed to give rise to the *chicken-broth* odour peculiar to certain springs. The latter is an organic substance, and belongs probably to a species of confervæ. But these vegeto-animal substances are of no importance from a therapeutical point of view; neither, in fact, are some of the other ingredients, which are present in far too small a quantity to exert any influence on the system, the really active principles of mineral waters being comparatively few, as CO_2 and H_2S, free or combined, chloride of sodium, sulphates, and carbonates of soda, iron, lime, and magnesia. But their activity is also in part due to the action of the water, used internally and externally, its temperature, bath appliances, and the adjuncts, as change of climate, diet, rest, removal from care, exercise, hope, &c. We shall here consider them briefly under six principal classes, namely—(1) Gaseous, acidulous, or carbonated; (2) Sulphurous, or hepatic; (3) Alkaline; (4) Chalybeate; (5) Bromo-ioduretted; and (6) Saline.

1. *Gaseous, Acidulous, or Carbonated Waters* are those which, in addition to their mineral ingredients, are more or less charged with carbonic-acid gas. They are generally limpid, colourless, and sparkling, and have a sharp sourish taste, and a feeble and evanescent acid reaction. These waters seldom owe their therapeutic value to their gaseous constituent alone, for it is usually associated with a variety of saline ingredients, some of which are held in solution by the gas, and are deposited when it escapes. After the escape of the gas, these waters have a flat, insipid taste; but when taken whilst strongly charged with it, they are refreshing and exhilarating, even almost to inebriety.

The kind of cases to which this class of springs is applicable depends upon their further constitution. The effect of the gaseous principle is to allay irritability of the digestive system, to increase and modify the secretion of the kidneys, and to excite the nervous system. Besides this, it imparts an increased activity to the other ingredients, rendering them more powerful in their effects upon the system. Such springs should be administered cautiously at first, for they sometimes produce unpleasant symptoms, of which fulness in the head is the chief. They should never be administered during active febrile or inflammatory conditions, nor where there is a tendency to apoplexy. They are largely used in cases of chronic irritable dyspepsia, and also to allay spasmodic action of the stomach and bowels, to arrest vomiting arising from functional causes, to quench the thirst attending chronic affections of the digestive organs, and generally to increase the powers of digestion, and to give an impulse to functional activity in all disorders consequent upon an atonic state of the abdominal viscera. Gaseous or acidulous waters are more commonly cold than hot; and common spring water, charged with carbonic-acid gas, with or without the addition of artificial salts, is not unfrequently substituted for them. Artificial seltzers or seltzer water is frequently used. We have examples of the thermal variety of this class of mineral waters in the springs of Ems, Wiesbaden, Schlangenbad, Gurgitello (in the island of Ischia), St Nectaire, Bath, Bristol, Buxton, &c.; and of the cold variety in the springs of Selters, Enghien, Apollinaris, Neuenbar, Vichy, Bilin, Marienbad, Geilnau.

2. *Sulphurous* or *Hepatic Waters* are characterised by the presence of hydrosulphuric acid, either in a free state or in combination in the form of a sulphuret. They are readily recognised by their disagreeable, fetid, rotten-egg-like odour, and their frequently bitter and saline, and always disagreeable taste. It is to the class of sulphuretted waters that the substances known as *glairine*, *baregine*, or *zoogine*, and *sulphuraire* belong. Sulphurous springs generally belong to the thermal class, and many of them have a very high temperature, but a few are cold. They usually contain also hydrochlorates, sulphates, and carbonates of soda, magnesia, and lime, and in some instances free carbonic-acid gas.

This class of mineral waters is more frequently used than any of the others, and is perhaps the most powerful variety that can be recommended as simple alteratives. The sulphurous waters act as excitants, quicken the circulation, and increase the functional activity of the skin and kidneys, producing free diaphoresis and a copious discharge of urine. At the same time they improve the appetite, and, according to the proportions of their ingredients, act as deobstruents and laxatives. Their use should be commenced with extreme caution, gradually increasing the dose if taken internally, or the duration of the bath when applied externally. If headache supervene, accompanied by a rapid pulse, with a feverish and sleepless state of the system, their use should be diminished, if not entirely suspended for a time. Their exhibition is indicated only in chronic states of disease. They are considered valuable remedial agents in chronic rheumatism; in chronic cutaneous diseases, especially in eczema, impetigo, psoriasis, lepra, prurigo, &c.; in many forms of functional affections of the uterus; in scrofula, in diseases of the joints, and in old cicatrices, especially those of gunshot wounds; in advanced stages of syphilis; in the elimination of cumulative medicines, such as mercury; in some forms of chronic bronchial and pulmonary affections, &c. Their internal administration may be combined with their local use in the form of baths, but their local action is mainly due to the warm water, and not to the action of the mineral constituents on the skin or their absorption, because the solution is too dilute to exercise any local action, and too little, if any, is absorbed to affect the system. We have examples of sulphurous waters in the thermal springs of Aix-la-Chapelle, Aix (Savoie), Baden (Austria), Schinznach, Barèges, Eaux-Bonnes, St Sauveur, Cauterets, Bagnères-de-Luchon, Bagnères-de-Bigorre, &c.; and in the cold springs of Enghien, Weilbach, Harrogate, Moffat, Strathpeffer, &c.

3. *Alkaline Waters* are characterised chiefly by the presence of carbonate and bicarbonate of soda in considerable quantity, and, in a less degree, by the presence of the carbonates of lime and magnesia. They contain also a variety of mineral ingredients besides these; but it is to the carbonates of soda especially that they owe their medicinal reputation. They are usually more or less charged with free carbonic-acid gas, so as to belong in part to the class termed *gaseous* or *acidulous*. These waters allay irritability of the mucous membrane lining the digestive apparatus, due to the presence of an uncombined acid; they are sedative in their effects upon the nervous system generally; and act also, like other varieties of mineral water, by increasing the functional activity of the skin and kidneys. They are recommended in certain kinds of dyspepsia complicated with acidity; in chronic bronchial and pulmonary affections; in chronic cutaneous affections; in certain calculous disorders; in diabetes and Bright's disease of the kidney; in gout; in glandular enlargements; in organic and functional diseases of the uterus, &c. Their exhibition requires extreme caution, not only in the selection of a suitable spring, but also in the mode of administering the waters. The *Grand Grille* at Vichy is the principal spring of this kind, and we have other examples in the thermal springs of Ems, Mont Dore, Ischia, &c., and in the cold springs of Bilin, Vals, Ilkestone, Malvern, &c.

4. *Chalybeate, Ferruginous, Martial,* or *Tonic Waters* are character-

ised by the presence of iron, usually in the form of carbonate, but sometimes as a sulphate. The carbonate of iron is held in solution by an excess of carbonic-acid gas, which, on the escape of the water from the ground, is readily liberated, leaving the oxide of iron as a red deposit, so common in the vicinity of these springs. These waters are recommended in all cases showing a want of red blood—that is, in anæmia, in scrofula, and other vitiated conditions of the system; in functional disorders of the uterine system; in chlorosis; in hysteria, epilepsy, chorea; in spermatorrhœa; in local nervous pains; and in many other affections in which the use of iron is indicated. The bowels should be carefully regulated during their administration, and their use should be suspended upon the appearance of head symptoms. This variety has so many representatives that it is almost impossible to make a small selection. The springs of Mont Dore, St Nectaire, Vichy, Töplitz, and Bath may pass for examples of the thermal class, and Pyrmont, Spa, Tunbridge, Hartfell, &c., for the cold variety.

5. *Bromo-iodurretted Springs* contain iodide of sodium and bromide of magnesium, associated with more or less of chloride of sodium, and other saline ingredients. Sea-water contains these principles, and is probably more useful, considering the conjoined advantages of sea-air and sea-bathing, than any of the springs recommended for the sake of their iodine and bromine. These waters are employed in strumous affections, in which they exercise a beneficial effect, especially apparent where there is marked glandular or cutaneous manifestation of the disorder. They are also used in cases of goitre, in uterine affections, in visceral congestions, and occasionally in rheumatism and gout. The action of these waters depends principally upon the chloride of sodium and other salts, and not upon the iodine and bromine; they act as stimulants locally, and internally increase functional activity, assimilation, and tissue metamorphosis, hence their use in strumous and glandular diseases. We have examples of this variety in the springs of Kreuznach, Kissingen, Homburg, Hall, Aix (Savoie), Castel Nuovo, Durckheim, Krankenheil, Woodhall, &c.

6. *Saline Waters* contain a variety of salts; in short, all mineral waters are saline, but for the sake of easier description they are usually divided, according to the acids which enter into their constitution, into carbonated, muriated or hydrochlorated, and sulphated waters. Waters containing free carbonic-acid gas have been considered under the head of gaseous, acidulous, or carbonated waters, and those containing the carbonates of sodium in excess have been mentioned as alkaline waters. The *Muriated Saline Springs* are char-

acterised by the presence of chlorides or muriates in preponderating quantity, although they may be associated with other ingredients, to which chiefly their medicinal reputation is attributable. Their principal ingredients are muriates of sodium, lime, and magnesium, to which may be added in smaller quantities the carbonates and sulphates of sodium, lime, magnesium, and iron, together with bromides and iodides, as well as a certain amount of free carbonic-acid or sulphuretted-hydrogen gas.

Their action is alterative, slightly purgative, and tonic, and they are employed in a variety of diseases, according to their natural combination with specific remedies, such as iron, sulphur, iodine, bromine, &c. Waters that contain chloride of sodium in great excess are called *brines* or *salt waters;* they are seldom used internally, and only when well diluted; but in the form of baths they are extensively employed. Waters, whose chief ingredients are the sulphate and carbonate of lime are called *calcareous* or *earthy waters.* The *sulphated salines* are characterised by the presence of sulphates in excess. They usually contain either the sulphates of sodium (Glauber salts), of magnesium (Epsom salts), or of lime, frequently associated with the sulphate of potasium, the muriates of sodium and magnesium, and the carbonates of sodium, lime, magnesium, or iron, together with more or less of free carbonic-acid gas. In the case of the Sandrock Spring, in the Isle of Wight, the sulphate of iron is in excess. Their action is aperient and alterative, and they are generally heavy of digestion, unless mixed with carbonic-acid gas. They are employed in cases requiring interference in the action of the secreting and excreting organs, to which they impart a decided stimulus, and through them relieve the system of many disorders. Those waters which contain the sulphates of sodium and magnesium in excess are called *bitter* or *purging* waters. Of saline springs the following are examples:—

1. *Simple Muriated Waters.*—Wiesbaden, Baden-Baden, Balaruc, Bourbonne-les-Bain, Niederbronn, Luxeuil, Kissingen, Homburg, Pyrmont, Cheltenham, Leamington, &c. 2. *Brines* or *Salt Waters*, sea-water.—Rehme, Nauheim, Kreuznach, Salzhausen, Ashby-de-la-Zouch, Middlewich, Nantwich, Droitwich, &c. 3. *Calcareous* or *Earthy Waters.*—Wildungen, Leuk, Lucca, Weissenburg, Lippspringe, Pisa, Bath, Buxton, Bristol, &c. 4. *Bitter* or *Purging Waters.*—Saidschütz, Sedlitz, Pullna, Kissingen, Friedrickshall, Epsom, Leamington, Cheltenham, &c.

Another class may be added here, viz., indifferent thermal springs, which have nothing to recommend them but a more or less elevated temperature, and have gained a certain reputation in the treatment of paralytic affections, and gout and rheumatism. Examples—Plombiéres, 66·2° = 143° F.; Teplitz, 95·5° = 108·5° F.; Gastein, 90·5° = 104° F.; Tuffes, 95° = 102·2° F.; Warmbrunn, 104·9° F.; Wiesbaden, 93·2° = 104° F. In England—Bath, 104° = 120° F.; Buxton, 82° F.; Bristol, 72° F.; Clifton, 74°; Matlock, 68°.

Mud Baths are formed of the soft earthy substances brought by certain mineral waters to the surface of the earth, and there deposited. They are applied either locally or generally, and in many diseases are considered to be more active than the waters themselves. They are used at many of the bathing establishments, such as Dax, Barbotan, St Amand, Acqui, &c., in a variety of diseases, of which chronic rheumatism, cutaneous affections, indolent ulcers, pseudo-anchylosis, injuries and diseases of the joints, bones, &c., are examples.

Sea-Water and Sea-Bathing.—Sea-water is richly charged with a diversity of saline ingredients. It is sometimes taken internally, when its effects vary according to the quantity imbibed. In doses of half a tumbler, occasionally repeated, it is alterative and tonic; in larger doses it is purgative, and as such is frequently employed as a deobstruent in congestion of the abdominal viscera. *Sea-bathing* is employed both in preventive and curative medicine. In the former it cleanses the skin, and renews its elasticity and contractility, thereby imparting additional vigour and activity to the frame, and lessening the tendency to take cold during exposure to vicissitudes of temperature. In the latter it operates much in the same way, adding firmness and tone to the textures, and so increasing the functional activity of the vascular, nervous, and secretory systems. In all cases showing impaired functional powers, without any manifestation of inflammatory symptoms—in short, in those cases in which the exhibition of alteratives and tonics is indicated—sea-bathing may, with proper precautions, be resorted to. It is contra-indicated in persons of plethoric habit of body, in cerebral congestion, in organic disease of the heart, in aneurism, and, indeed, in such cases as have not the ability to encounter the severe shock; and, moreover, at certain periods in which the female constitution is not prepared for the application of powerful remedies.

Factitious Mineral Waters were formerly much employed in cases in which the patients could not be conveniently removed to the springs, and many formulæ have been constructed for the imitation of the more popular waters; but the means of transport between different countries are now so greatly increased, that the mineral waters of any district can be readily and cheaply imported. It is, however, certain that mineral waters act most beneficially when taken at the spring, probably because of the adjuvant circumstances as change of climate, scenery, habits, &c.

NITROGEN ($N=14$).

Preparation.—Nitrogen may be readily obtained by burning phosphorus in confined air, or by otherwise depriving atmospheric air of its oxygen.

Characters.—It is a permanent, colourless, tasteless, inodorous gas, having a specific gravity of 0·967. It does not support combustion; and although it is an essential constituent of atmospheric air, it cannot be respired in a pure state without destroying life—a result due, probably, rather to the absence of oxygen than to any poisonous effects of the nitrogen itself.

Therapeutics.—It has been recommended, mixed with common air, as a sedative in certain pulmonary affections, but it is not used alone as a therapeutic agent. As a constituent of the *flesh-forming* principles, it is an essential article of diet.

PROTOXIDE OF NITROGEN (N_2O) (not official)—Nitrous Oxide Gas —Laughing Gas—obtained by heating nitrate of ammonium at a temperature of 400° F. (204°·44 C.), when the salt breaks up into nitrous oxide and water—$NH_4NO_3 = N_2O + 2H_2O$.

The gas thus obtained is washed by passing it in succession through water, caustic potash, and solution of protosulphate of iron to free it from mechanical impurities, CO_2, and the higher oxides of nitrogen.

Characters.—A tasteless inodorous gas, sp. gr. 1·725, it is liquefied by a pressure of 50 atmospheres at 45° F. (7°·22 C.), when its sp. gr. is 0·908.

It produces remarkable effects when respired by man. It generally gives rise to a kind of temporary delirium, accompanied by an exuberance of muscular activity, which takes the form of dancing, fighting, singing, &c., according to the natural proclivity of the individual. It has been used therapeutically in spasmodic asthma, paralysis, and other diseases, but is now rarely employed in the treatment of such affections. It is possessed of valuable anæsthetic properties, and has lately come into very general use in dentistry operations, where it has in a great measure superseded chloroform. Though not absolutely free from danger, it has proved itself much safer in this branch of surgery than chloroform. It induces complete unconsciousness, usually in about 60 seconds; but its effects pass off in about 30 seconds, so that it is best suited for rapid operations, where only one or two teeth have to be extracted. It acts essentially in producing a temporary asphyxia by diminishing the amount of oxygen contained in the blood, the lips become blue, the pupils dilated, and the breathing stertorous. For inhalation it needs to be perfectly pure, and also requires a special apparatus. For tedious operations the gas is sometimes given repeatedly at one sitting, but most dentists under such conditions rather prefer chloroform.

CHLORINE ($Cl=35·5$ χλωρός; *green*)—Chlorum—Chlórinium.

Preparation.—Chlorine may be obtained by the following, besides other methods:—By the action of sulphuric acid upon a mixture of chloride of sodium and black oxide of manganese ($2NaCl+MnO_2+H_2SO_4=Na_2SO_4+MnSO_4+2Cl$) or by the action of peroxide of manganese upon hydrochloric acid with the aid of a gentle heat ($4HCl+MnO_2=2H_2O+MnCl_2+2Cl$).

Characters.—Chlorine gas has a yellowish-green colour, a pungent, suffocating odour, so that it cannot be respired unless it be sufficiently diluted, and a somewhat astringent taste. It can be reduced to a liquid, under a pressure of four atmospheres, at a very low temperature. Its specific gravity is 2·47; it is soluble in water, and, in the presence of moisture, destroys vegetable colours. With nitrate of silver, it gives a curdy white precipitate, which is insoluble in dilute nitric acid, but soluble in ammonia.

VAPOR CHLORI—Inhalation of Chlorine.

PREPARATION.—*Take of chlorinated lime,* 2 *ounces; water (cold), a sufficiency. Put the powder into a suitable apparatus, moisten it with the water, and let the vapour that arises be inhaled.*

Liquor Chlori—Chlorine Water—Chlorine gas dissolved in half its volume of water, and constituting 0·006 of the weight of the solution.

PREPARATION.—*Take of hydrochloric acid,* 6 *fluid ounces; black oxide of manganese, in fine powder,* 1 *ounce; distilled water,* 34 *fluid ounces. Put the oxide of manganese into a gas-bottle, and having poured upon it the hydrochloric acid, diluted with* 2 *ounces of the water, apply a gentle heat, and, by suitable tubes, cause the gas, as it is developed, to pass through* 2 *ounces of the water placed in an intermediate small phial, and thence to the bottom of a three-pint bottle containing the remainder of the water, the mouth of which is loosely plugged with tow. As soon as the chlorine ceases to be developed, let the bottle be disconnected from the apparatus in which the gas has been generated, corked loosely, and shaken until the chlorine is absorbed. Lastly, introduce the solution into a green-glass bottle furnished with a well-fitting stopper, and keep it in a cool and dark place.*

Characters.—A yellowish-green liquid, smelling strongly of chlorine, andimmediately discharging the colour of a dilute solution of sulphate of indigo. Sp. gr. 1·003.

Therapeutics.—Liquor chlori, when administered of full official strength, acts as a powerful irritant, causing inflammation of the skin when applied externally, and acting as an irritant poison when taken internally, causing gastero-enteritis. Antidotes—albumen, as white of egg, milk, flour, lime-water, chalk, soap, and magnesia. When sufficiently diluted, it operates as a stimulant and alterative, besides exercising to a certain extent the disinfectant and antiseptic properties of the undiluted gas. It has been said to cause salivation after long administration. It has been recommended internally in the lowest forms of fever having a malignant tendency, such as typhus, typhoid, smallpox, and scarlatina; also in certain chronic diarrhœas, in epidemic dysentery, in erysipelas, and as an alterative in chronic diseases of the liver and in syphilitic affections. Dose of the liquor, 10 to 30 drs., well diluted in water. It has also been used as an application in cutaneous affections, including certain forms of herpes and psoriasis, tinea, porrigo, scabies, &c., and it has been applied at the period of eruption in variola. It is useful as a stimulating and antiseptic application to cancerous and sloughing ulcers. It is a deodoriser by liberating hydrogen, and thus it destroys NH_3, H_2S, and sulphide of NH_4, on which the odour of decomposing animal and vegetable substances depends; and antiseptic by destroying the germs of disease, by oxidising them. As a gargle, it is serviceable in malignant sore-throat and aphthous and other ulcerations of the mouth and fauces. As an antidote, it has been recommended in cases of poisoning by hydrocyanic acid, sulphuretted hydrogen, sulphide of ammonium—in the former by rousing the system, and in the latter by precipitating the S, and forming HCl.

Calx Chlorinata—Chlorinated Lime—a product obtained by exposing slaked lime to the action of chlorine gas as long as the latter is absorbed. It possesses bleaching and disinfecting properties. It may be regarded as consisting chiefly of a compound of hypochlorite and chloride of calcium ($CaCl_2O_2$, $CaCl_2$), or as a direct compound of chlorine and lime ($CaOCl_2$).

Characters.—A dull white powder, with a feeble odour of chlorine, partially soluble in water. The solution evolves chlorine copiously upon the addition of oxalic acid, and deposits at the same time oxalate of calcium.

Liquor Calcis Chlorinatæ—Solution of Chlorinated Lime. —*Take of chlorinated lime*, 1 *pound; distilled water*, 1 *gallon. Mix* *well the water and the chlorinated lime by trituration in a large mortar, and, having transferred the mixture to a stoppered bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle.*

Therapeutics.—Calx chlorinata acts upon the system in essentially the same manner as liquor chlori, but is principally used externally. It acts as an irritant, antiseptic, and disinfectant. As a local stimulant and purifying agent in unhealthy and fetid sores. In solutions of various strengths it may be applied as a gargle in malignant sore-throat, and as a wash in ulcers of the mouth, tongue, gums, and lips, and also in mercurial ptyalism; as an injection in fetid discharges from the nose and ears; and, well diluted, as a topical application in purulent ophthalmia; as a lotion in cancerous and other ulcers producing fetid discharges; as an injection in fetid discharges from the uterus, vagina, or rectum; as an application to cutaneous affections, especially scabies; and as a local application to the skin in erysipelas; as an application to glandular swellings and sores of a scrofulous nature.

Liquor Sodæ Chlorinatæ—Solution of Chlorinated Soda.

PREPARATION.—*Take of chlorinated lime,* 16 *ounces; carbonate of sodium,* 24 *ounces; distilled water,* 1 *gallon. Dissolve the carbonate of sodium in* 2 *pints of the distilled water; thoroughly triturate the chlorinated lime with* 6 *pints of the water, and filter. Well mix the solutions; again filter. Keep the solution in a stoppered bottle in a cool and dark place.*

Characters.—A colourless alkaline liquid, with astringent taste and feeble odour of chlorine. It decolorises sulphate of indigo. It is decomposed by hydrochloric acid, evolving chlorine and little or no carbonic acid gas; sp. gr. 1·054.

Dose.—10 to 20 mins.

CATAPLASMA SODÆ CHLORINATÆ—CHLORINE POULTICE.—*Take of solution of chlorinated soda,* 2 *fluid ounces; linseed meal,* 4 *ounces; boiling water,* 8 *fluid ounces. Mix the linseed meal gradually with the water, and add the solution of chlorinated soda with constant stirring.*

Therapeutics.—Liquor sodæ chlorinatæ is used both internally and externally for the same purposes, and in a similar class of cases, as was mentioned under chlorine water and calx chlorinata; but for internal purposes, and in certain cases of local treatment, it is generally preferred to the solution of calx chlorinata. Dose internally, xx. to xxx. mins.; externally as a lotion or gargle, ʒi. to ℥ſ. to ʒii. of water.

Group II. Liquid.—Bromine.

BROMINE ($Br=80$; βρῶμος, a stench)—Bromum—a liquid non-metallic element obtained from sea-water, and from some saline springs.

Preparation.—After all the salts that are capable of separation by crystallisation have been removed from the mother-liquor of sea-water, there still remains in it bromine, principally in the form of bromide of magnesium. In order to obtain bromine in its elementary form, the bromide is decomposed by subjecting the liquid to the influence of chlorine, which, seizing upon the magnesium to form chloride of magnesium, sets the bromine free. Sulphuric ether is next agitated with the liquid: this abstracts the bromine. The ethereal solution of bromine is separated from the mother-liquor, and is agitated with a solution of hydrate of potash, whereby bromide of potassium and bromate of potash are formed in solution. The ether is then recovered, the salts of potash are dried by evaporation, and are exposed to a dull red heat, in order to convert, by deoxidation, the bromate of potash into bromide of potassium. The bromide is next mixed with peroxide of manganese, sulphuric acid, and water, and distilled into a cold receiver, where the orange-coloured vapour is condensed into liquid bromine ($2H_2SO_4+2KBr+MnO_2=K_2SO_4+MnSO_4+2H_2O+Br_2$).

Characters.—A dark brownish-red, very volatile, liquid, with a strong and disagreeable colour. Its specific gravity is 2·97 to 3·14. At the common temperature of the air it gives off red vapours, and at a temperature of 135° to 145° F. (57°·2 to 62°·87 C.) it boils.

Bromine, like chlorine, bleaches certain vegetable colours in the presence of moisture; but when quite dry it does not remove their colour, so that its bleaching property is probably due to its affinity for hydrogen, the oxygen of the H_2O being set free to operate in its nascent state as a decoloriser. It is but very slightly soluble in water, imparting to it a yellow colour; is more readily soluble in alcohol, and still more so in ether. It combines with many of the metals to form bromides. It stains the skin yellow, and gives an orange-yellow colour with starch. It should be preserved under a layer of water in a stoppered bottle.

Therapeutics.—Bromine in its elementary form is little used in medicine. Medicinally, it may be said to occupy a position mid-way between chlorine and iodine, inclining rather more towards the former, and being relatively stronger than the latter. The vapour of bromine is exceedingly irritant, and in its pure state is irrespirable. When somewhat diluted, it causes great irritation of the air passages, attended by dyspnœa, cough, hoarseness, and an increased flow of the secretions from the eyes, nose, and throat. It acts partly by its topical irritant action, and partly by its absorption into the circulation. In larger doses it is irritant and caustic. In full poisonous doses bromine causes intense pain in the stomach and bowels, with difficult deglutition and dyspnœa, painful vomiting and purging, and ultimately fatal collapse. In large and continued doses it causes general debility and languor, with headache, colicky pains, diarrhœa, and sometimes salivation. It is principally used locally as a caustic to gangrenous and sloughing sores and cancer of the uterus. It is used internally now only in the form of one or other of its salts, the bromides, for the preparation of which it is introduced into the Pharmacopœia.

Bromide of Potassium (KBr)—Potassii Bromidum.

Preparation.—*Take of solution of potash*, 2 *pints; bromine*, 4 *fluid ounces, or a sufficiency; wood charcoal, in fine powder*, 2 *ounces; boiling distilled water*, $1\frac{1}{2}$ *pint. Put the solution of potash into a glass or porcelain vessel, and add the bromine in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in the water, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle.*

Characters.—In colourless cubical crystals, with no odour, but a pungent saline taste, readily soluble in water, less soluble in spirit. Its aqueous solution gives a white crystalline precipitate with tartaric acid. When its solution in water is mixed with a little chlorine, chloroform agitated with it, on falling to the bottom, exhibits a red colour. Dose 5 to 60 grains.

Therapeutics.—The bromide of potassium has, within the last few years, become one of the most frequently-used medicines. Though, no doubt, some properties have been attributed to it which it does not possess, yet it is unquestionably one of the most valuable recent additions to the *Materia Medica.* Introduced into medicine in this country by Dr R. Williamson, in 1831, for the treatment of certain splenic and hepatic enlargements, it took little hold on the profession at large till recommended by Sir Charles Locock, in 1853, as the best treatment for hysterical epilepsy and nymphomania. Since that period, it has been gradually gaining ground, and the sphere of its applicability steadily widening.

Physiologically, it is a direct nervine sedative and depressant, having no preliminary period of excitement like opium and belladonna. It depresses the action of the heart and the respiratory function, reducing its force and frequency, and in addition is believed to cause vaso-motor spasms. Large doses cause drowsiness, and tendency to sleep, the sensibility of the skin and mucous membrane is lowered, and voluntary motion is impaired by the long-continued use of the bromides. It also diminishes excitement of the sexual organs, a fact established by abundant clinical experience. This result, however, is not produced in all cases with equal facility, and large doses are necessary.

When full doses have been administered for some time, a group of symptoms, collectively termed bromism, occur, viz., depression of spirits, mental weakness, pallor, and anæmia—an eruption of acne on the face, the complexion becoming muddy or bronzed, fœtid breath, and feeble heart's action. In addition there may be muscular weakness, a feeling of coldness, diminished sensibility of the skin and mucous membrane, so that irritation of the fauces is not felt, and usually there is abolition of the sexual functions. In every case all these symptoms are not present, but if the remedy is pushed they are all developed.

It is therefore manifest that bromide of potassium acts as a depressant, affecting decidedly the circulation, diminishing the blood supply of various organs, and reducing the temperature and respiration. It depresses the cerebral functions, probably by causing anæmia. It lowers the reflex excitability of the cord, and destroys or impairs the irritability of the motor and sensory nerves. Its effects on the circulation can only be accomplished by a sedative influence on the sympathetic system, and some observers, as Reynolds and Amory, maintain that on this action depends all its physiological power. It is eliminated by the kidneys, bowels, skin, and mucous membranes.

Therapeutically, it is employed as a sedative to allay irritation generally, to quiet cerebral excitement, to induce sleep, to diminish over-susceptibility of the spinal centres to reflex actions, or of the peripheral afferent nerves which lead to these centres, to subdue excitement of the genital system, and diminish congestion. It is contra-indicated in very feeble or exhausted individuals :—

1. Bromide of potassium is most useful as a sedative, to induce sleep in wakefulness from mental worry and excitement, as from fatigue or anxiety, convalescence, abuse of alcohol, pregnancy, &c. But its hypnotic action is neither so powerful or certain as that of opium or chloral; it acts more indirectly by allaying restlessness, mental as well as bodily. It has the advantage over opium and chloral that it can be administered with safety in all cases and in large doses; it does not derange the digestive functions or nervous system, and even when taken for a considerable time does not induce effects anything like so disastrous as that of the opium habit. It can also be given in cerebral congestion, as in typhus and other fevers when opium is contra-indicated. But it is of little use in wakefulness from physical pain. It is also useful in acute mania, puerperal mania, nymphomania, and in other forms of excitement connected with the sexual organs, as at the menstrual flow, in too frequent seminal emissions, provided there is no inflammatory affection. But as a rule, in melancholia and hypochondriasis, conditions usually associated with bodily weakness, it is not so useful.

2. To lessen reflex activity, as in epilepsy and other convulsive nervous affections. It is employed with the best result in epilepsy, in most cases diminishing the severity and frequency of the attacks, and in some arresting them entirely. To attain this object it must be given in full doses and be taken regularly, even for some time after the cessation of the attacks. It is not, however, equally beneficial in all cases. Thus it is not so useful when the convulsions are violent, or when there is only a transitory loss of consciousness, as in petit mal. It is most useful in regular epileptic convulsions of sexual or alcoholic origin. It is also very useful in infantile convulsions from reflex irritation along with chloral. In poisoning from strychnia, along with chloral given during the interval of the convulsions.

3. In certain respiratory neuroses, as laryngismus stridulus, asthma, hooping-cough, and reflex cough, either alone or with chloral or belladonna, it is advantageous. It also often affords relief in sea-sickness and sickness in pregnancy. In menorrhagia, occurring in young women. In congestive neuralgia it often affords relief.

4. As an anaphrodisiac in nymphomania, satyriasis, spermatorrhœa, and chordee.

Dose.—5 to 60 grains in water, or a bitter infusion. If acne become troublesome, it may be combined with a little liquor arsenicalis.

Bromide of Ammonium (NH_4Br)—AMMONII BROMIDUM.—May be prepared in the same manner as bromide of potassium, liquor ammoniæ being used instead of liquor potassæ, or by neutralising hydrobromic acid with ammonia, evaporating, and crystallising.

Characters.—In colourless crystals, which become slightly yellow by exposure to the air, and have a pungent saline taste. May be sublimed unchanged by the application of heat. Readily soluble in water, less soluble in spirit.

Dose.—One grain for each year of the child's age in hooping cough; for adults, v to xv grains thrice a-day, in a suitable vehicle; or in occasional doses of xx or more grains.

Therapeutics.—The actions of bromide of ammonium are allied to those of the bromide of potassium, and it has been recommended in similar cases. But it is not so powerful, and it differs from the bromide of potassium in having an action on the mucous membrane of the lungs, hence its use in hooping cough, asthma, &c. It is less likely to induce bromism than the potassium salt, and it has the same specific effect on the mucous membranes of the throat. It may be given instead of the bromide of potassium or mixed with it, as, according to some, the mixture of the two salts produce a more decided effect than either salt given above.

GROUP III. SOLID.—IODINE, SULPHUR, CARBON, PHOSPHORUS.

IODINE (I = 127; *ἰώδης, violet*, the colour of its vapour)—Iodum—a non-metallic element, obtained from the ashes of sea-weed and from mineral iodides and iodates.

Preparation.—Iodine exists in minute quantity in sea-water, from which it is abstracted by the marine plants, from whose tissues it is obtained for commercial purposes. It is prepared from *kelp* (the ashes of burned sea-weed, chiefly *fuci* and *laminaria*), obtained from the Hebrides and Orkneys, and from the west coast of Ireland. The following is a sketch of the manufacturing process:—The sea-weed, sun-dried, and burned at a low heat, yields kelp, which is crushed, and then submitted to boiling water, which takes up about one-half of the substance. This solution is partially evaporated in open pans, whereby sulphates of potash and soda, carbonate of sodium, and chloride of potassium are removed by crystallisation. The liquid that remains—called *mother-liquor* or *iodine ley*—still contains sulphide of sodium, together with hyposulphite and carbonate of sodium, and iodine, in the form of *iodide of sodium*. In order to separate the iodine, sulphuric acid is first added to the iodine ley, and it is allowed to stand for twenty-four hours; during this period there is an escape of carbonic-acid, sulphurous-acid, and sulphuretted-hydrogen gases, sulphate of sodium being at the same time crystallised out and sulphur deposited. The supernatant liquor is next transferred to a leaden retort, heated to 140°, and a quantity of black oxide of manganese, in powder, is added; from this mixture iodine is carefully and slowly distilled, and is received into a series of spherical glass condensers, connected with the conducting tube of the still. The changes which take place are probably these—$2NaI + MnO_2 + 2H_2SO_4 = Na_2SO_4 + MnSO_4 + 2H_2O + I_2$.

Characters.—Laminar crystals of a peculiar odour, dark colour, and metallic lustre, which, when heated, yield a beautiful violet-coloured vapour; very sparingly soluble in water, but freely dissolved by alcohol, by ether, and by a solution of iodide of potassium. The aqueous solution strikes a deep blue colour with starch.

Dose.—Iodine is seldom administered in the pure form, but may be given in doses, gradually increased from half a grain to a grain, well diluted in water, after food, or the tincture or liquor in doses of 5 to 20 mins.

Linimentum Iodi—Liniment of Iodine.—*Take of iodine,* 1¼ *ounce; iodide of potassium,* ½ *ounce; glycerine* ¼ *ounce; rectified spirit,* 10 *fluid ounces. Dissolve the iodine and iodide of potassium and camphor in the spirit.*

Liquor Iodi—Solution of Iodine.

Preparation.—*Take of iodine,* 22 *grains; iodide of potassium,* 33 *grains; distilled water,* 1 *fluid ounce. Dissolve.*

This solution is a little more than one-third the strength of the liniment, and nearly twice the strength of the tincture. For purposes of mild counter-irritation, it may be used externally for the liniment, and it may be substituted, on account of its cheapness, for the tincture for internal use. Dose, internally, min. v to xx.

Tincture Iodi—Tincture of Iodine.—*Take of iodine,* ½ *ounce; iodide of potassium,* ¼ *ounce; rectified spirit,* 1 *pint. Dissolve the iodine and the iodide of potassium in the spirit.*

The tincture may be given internally in doses gradually increased from min. x to xx or xxx, sufficiently diluted with water; but it is more commonly used as an external application, for which it is a mild preparation.

Unguentum Iodi—Ointment of Iodine.—*Take of iodine, iodide of potassium, of each,* 32 *grains; glycerine,* 1 *fluid drachm; prepared lard,* 2 *ounces. Rub the iodine and the iodide of potassium well* *together, with the glycerine in a glass or porcelain mortar, add the lard gradually, and mix thoroughly.*

The iodine ointment is used as an external application to enlarged glands, &c.

Vapor Iodi—Inhalation of Iodine.

Preparation.—*Take of tincture of iodine,* 1 *fluid drachm; water* 1 *fluid ounce. Mix in a suitable apparatus, and having applied a gentle heat, let the vapour that arises be inhaled.*

This preparation is suitable for chronic pulmonary affections, such as bronchitis and phthisis, which are often benefited by the stimulating effect of inhaled vapour of iodine.

Therapeutics.—Topically, iodine acts as an irritant and vesicant, causing more or less of local pain and general uneasiness, according to the strength and form of the preparation, and the delicacy of structure to which it is applied. It stains the skin yellow or brown, and, according to the strength of the preparation or frequency of the application, either passes off, leaving the skin uninjured, or else causes its immediate vesication or gradual desquamation. When applied to serous and mucous membranes, as by injection into cavities, by inhalation, or by ingestion, it gives rise to irritation, varying in degree according to the quantity and strength of the preparation; when inhaled, it may cause irritation of the respiratory mucous membrane, accompanied by distressing cough, coryza, and flow of tears; when taken into the stomach, it may cause heat and constriction of the fauces and œsophagus, epigastric pain, vomiting, colic, salivation, &c.

Fatal cases of poisoning by iodine are rare. The symptoms are those attending irritation and inflammation of the alimentary mucous membrane; namely, heat and constriction of the fauces and gullet, with intense thirst, violent pain in the stomach and bowels, which is aggravated by retching, vomiting, and purging, utter prostration, and fatal collapse, one fatal result having occurred after injection of an ovarian cyst. When administered internally, whether free or combined, as iodide of potassium, all we know of its physiological action is, that it modifies nutrition and acts as a stimulant to the lymphatic system, causing absorption. Hence, as an alterative, it is of great value in chronic scrofula with indolent enlargement of the lymphatic glands, in chronic enlargements of joints and bone affections. But for other purposes, as an alterative, iodide of potassium does equally well, if not better, as its action depends principally on the iodine which it yields to the system. But it differs from iodine in having no local or but very slight irritant action on the stomach, which is of great importance, as it is a remedy which usually requires to be administered for some time, hence it is much more frequently used; besides, it has a wider range of employment. In full medicinal doses continued for some time it produces a group of symptoms, which are collectively termed iodism. According to Rilliet, there are three stages of iodism—the first is characterised by gastric irritation ; the second by ringing in the ears, coryza, headache, conjunctival inflammation, vomiting, and diarrhœa ; the third by iodic cachexia, emaciation, palpitation, hypochondriasis, and wasting of testes and mammæ.

Sometimes one or other of the foregoing physiological effects is alone manifested: in some patients *coryza* invariably follows the use of iodine, or even iodide of potassium. Headache, tinnitus aurium, or impaired vision, may ensue. A marked increase of appetite is a common result ; diuresis frequently follows its use ; irritation of the bowels, with diarrhœa, sometimes requires the addition of opium; salivation is occasionally a consequence.

Iodine, in one or other of its forms, internally or externally, has been employed in the cure of more diseases than we have space even so much as to enumerate. Like many other remedies which have proved themselves trustworthy in certain maladies, it has suffered by being pressed into every kind of service. The diseases in which it has been of most use are those of a scrofulous or syphilitic character. Internally, and applied at the same time to the part, it is employed for the resolution of enlarged lymphatic glands, and for the healing and obliteration of scrofulous abscesses and ulcers. In all cases complicated with scrofula, the treatment of each of which depends to a certain extent upon the part affected—as the eye, ear, joints, bones, &c.—the use of iodine, or the iodides, is indicated. It is often advantageous to give along with it iron and cod-liver oil, especially in anæmic and badly-nourished individuals.

Internally, it is used with great advantage in the treatment of syphilis, in cases and in stages of the disease in which mercury is inadmissible, or has been used unavailingly; externally, it is applied to syphilitic nodes and gummata. Both internally and externally, it has been recommended in hypertrophies of a sub-inflammatory origin, in indurations, and ulcers of the breast, tongue, tonsils, ovary, uterus, &c. In many obstinate chronic cutaneous diseases, more especially if referable to syphilitic, arthritic, or strumous cause, it is of undoubted benefit. In phthisis, and chronic bronchitis, it has been recommended both in the solid form of the several iodides, and also in the form of iodine inhalation. In tubercular meningitis, in acute, sub-acute, and chronic rheumatism, in gonorrhœal rheumatism, and in rheumatic gout, in affections of the liver and spleen, in chronic and sub-acute inflammations of serous membranes, as in pleurisy and peritonitis, in the kidney affection of scarlatina, as a substitute for nitrate of silver in erysipelas, as an injection into encysted tumours, in the radical cure of hydrocele, in various dropsies, and in very many more diseases, either given internally to act as an alterative and deobstruent, externally to act as a counter-irritant, discutient, or escharotic, or injected into cavities for the purpose of procuring their obliteration by setting up adhesive inflammation, iodine, in one or other of its forms, has been recommended.

In the cure of *goitre* or bronchocele, burned sponge and other remedies, as certain mineral springs, were used before it was known that they contained iodine; for the cure of this disease iodine is now most successfully used both internally and externally.

In acute inflammatory and febrile attacks, especially where there is an irritable condition of the alimentary mucous membrane, the preparations of iodine are generally contra-indicated.

Iodide of Potassium (KI)—Potassii Iodidum.

PREPARATION.—*Take of solution of potash,* 1 *gallon; iodine, in powder,* 21 *ounces, or a sufficiency; wood charcoal, in fine powder,* 3 *ounces; boiling distilled water, a sufficiency. Put the solution of potash into a glass or porcelain vessel, and add the iodine, in small quantities at a time, with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness in a porcelain dish, pulverise the residue, and mix this intimately with the charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in* 2 *pints of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole until a film forms on the surface. Set it aside to cool and crystallise. Drain the crystals, and dry them quickly in a warm place. More crystals may be obtained by evaporating the mother-liquor and cooling. The salt should be kept in a stoppered bottle.*

Characters.—In colourless, generally opaque, cubic crystals, readily soluble in water, and in a less degree in spirit. It commonly has a feebly alkaline reaction; its solution, mixed with mucilage of starch, gives a blue colour on the addition of a minute quantity of solution of chlorine. It gives a crystalline precipitate with tartaric acid.

Dose of Iodide of Potassium.—The dose ranges to a wide extent, even from 2 grains to half a drachm; commonly, from 3 to 10 grains, thrice daily, in simple water or bitter infusions.

UNGUENTUM POTASSII IODIDI—OINTMENT OF IODIDE OF POTASSIUM. —*Take of iodide of potassium*, 64 *grains; carbonate of potassium*, 4 *grains; distilled water*, 1 *fluid drachm; benzoated lard*, 1 *ounce. Dissolve the iodide of potassium and carbonate of potassium in the water, and mix thoroughly with the lard.*

This ointment is used as an application to glandular enlargements; being colourless, it may be applied to exposed parts without disfiguring the patient, but its local action is very slight.

Therapeutics.—Iodide of potassium gives rise to the physiological symptoms collectively termed *iodism*, but being less irritant than pure iodine, it does not generally produce symptoms of gastric irritation. Coryza appears to be the most common physiological manifestation of its action, sometimes attended by swelled face. Salivation, emaciation, general or local, gastric irritation, with vomiting and purging, headache, &c., may also result from its use. But it is often given in large and long-continued doses without producing any untoward effects.

Iodide of potassium is more frequently given internally than any other preparation of iodine; and it has been recommended in the diseases mentioned under iodine, of which it possesses all the alterative, discutient, and deobstruent virtues. It is often beneficially administered in combination with bromide of potassium, with which it agrees in deobstruent action; while the bromide acts as a general and nervine sedative, and tends to diminish the capillary congestion.

In the treatment of *internal aneurism* it has lately been found exceedingly useful in alleviating the sufferings of the patients, and even in promoting a cure by consolidation of the tumour. Dr George W. Balfour, from extensive trial of its virtues in this disease, is led to believe that its prolonged use in large doses (20 to 30 grains, thrice daily) leads to contraction of the aneurismal sac, probably by a sedative influence on the circulation, its action being aided by rest in the recumbent position. The iodide of potassium is the most valuable agent we have in the treatment of tertiary syphilis. It is also of use in the secondary stage of that disease. It is most effective in removing the pains of syphilitic nodes, and pains of all kinds referable to syphilitic tissue change. It is sometimes useful in sciatica, lumbago, cephalalgia, and chronic rheumatism, and in gout. It is of signal benefit in diseases of the liver, kidneys, spleen, and of internal organs generally, if the disease is associated with syphilis.

It has been used successfully for the elimination of lead and mercury in cases of chronic poisoning by these substances; the iodide renders them soluble, and at first the symptoms of poisoning may be aggravated in consequence, but ultimately the patient is relieved. It is, however, necessary to prescribe iodide of potassium with great care to a patient who has been taking mercury recently, because injurious salivation is liable to occur in a certain proportion of such cases.

Linimentum Potassii Iodidi cum Sapone—Liniment of the Iodide of Potassium and Soap.

PREPARATION.—*Take of curd soap,* 2 *ounces; iodide of potassium,* 1½ *ounce; glycerine,* 1 *fluid ounce; oil of lemon,* 1 *fluid drachm; distilled water,* 10 *fluid ounces. Dissolve the soap in* 7 *fluid ounces of the water by the heat of a water-bath. Dissolve the iodide of potassium and glycerine in the remainder of the water, and mix the two solutions together. When the mixture is cold, add the oil of lemon, and mix the whole thoroughly.*

Sulphuris Iodidum (S_2I_2)—Iodide of Sulphur.

PREPARATION.—*Take of iodine,* 4 *ounces; sublimed sulphur,* 1 *ounce. Rub them together in a Wedgewood mortar until they are thoroughly mixed. Put the mixture into a flask, close the orifice loosely, and apply a gentle heat, so that the colour of the mass shall become gradually darkened. When the colour has become uniformly dark throughout, increase the heat so as to produce liquefaction. Then incline the flask in different directions, in order to return into the liquid any portion of the iodine which may have been condensed on the inner surface of the vessel. Lastly, withdraw the heat; and when the liquid has congealed, remove the mass by breaking the flask, reduce it to pieces, and keep these in a well-stoppered bottle.*

Characters.—A greyish-black solid substance, with a radiated crystalline appearance. It resembles iodine in smell and in the property of staining the skin. Soluble in about 60 parts of glycerine, insoluble in cold water. If 100 grains be thoroughly boiled with water, the iodine will pass off in vapour, and about 20 grains of sulphur will remain.

TESTS.—*It resembles iodine in smell, and in the property of staining the cuticle when applied to it. Soluble in about* 60 *parts of glycerine; insoluble in water, but decomposed when boiled with it. If* 100 *grains be thoroughly boiled with water, the iodine will pass off in vapour, and about* 20 *grains of sulphur will remain.*

Unguentum Sulphuris Iodidi—Ointment of Iodide of Sulphur.

Preparation.—*Take of iodide of sulphur* 30 *grains; hard paraffin* $\frac{1}{4}$ *ounce; soft paraffin,* $\frac{3}{4}$ *ounces. Triturate the iodide of sulphur in a glass or porcelain mortar, and gradually add the melted mixture of the hard and soft paraffin, rubbing them together until the ointment is perfectly cold and free from gritiness.*

Therapeutics.—This preparation has been occasionally used as an alterative internally, in doses of from 1 to 6 grains, and as vapour inhalation in cases of chronic bronchitis with emphysema. Its chief employment is, however, externally, as a stimulant and deobstruent application in squamous and tubercular forms of skin disease. It has been found advantageous in acne indurata and rosacea, in herpes labialis pustulosus, in chronic eczema, and psoriasis. It is applied in the form of ointment prepared as above.

Plumbi Iodidum (PbI_2)—Iodide of Lead.

Preparation.—*Take of nitrate of lead, iodide of potassium, of each* 4 *ounces; distilled water, a sufficiency. Dissolve the nitrate of lead, by the aid of heat, in* $1\frac{1}{2}$ *pint, and the iodide of potassium in* $\frac{1}{2}$ *pint of the water, and mix the solutions. Collect the precipitate on a filter, wash it with distilled water, and dry it in a warm place.*

Iodide of Lead Plaster—Emplastrum Plumbi Iodidi.

Preparation.—*Take of iodide of lead,* 2 *ounces; resin,* 2 *ounces; lead plaster,* 1 *pound. Add the iodide of lead in fine powder to the plasters, previously melted, and mix them intimately.*

Unguentum Plumbi Iodidi—Ointment of the Iodide of Lead.

Preparation.—*Take of iodide of lead, in fine powder,* 62 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

Iodide of lead is seldom given internally, and it is still undetermined whether its characteristic actions incline more towards the iodine or towards the lead of its constitution. It has been given internally, in doses of from half a grain to 2, 3, or more grains, in the form of a pill; but it is chiefly used as an external application in the forms of the ointment and plaster. It is beneficial as an application to scrofulous affections of the glands, joints, &c., and to chronic cutaneous affections, especially those of the scalp.

Ferri Iodidum—Iodide of Iron ($Fe\ I_2$) (not official in the separate form, but occurring in two preparations in the Pharmacopœia, namely, Pilula and Syrupus Ferri Iodidi).

PILULA FERRI IODIDI—Pill of Iodide of Iron.—*Take of fine iron wire,* 40 *grains; iodine,* 80 *grains; refined sugar, in powder,* 70 *grains; liquorice root, in powder,* 140 *grains; distilled water,* 50 *minims. Agitate the iron with the iodine and the water in a strong stoppered ounce-phial until the froth becomes white. Pour the liquid upon the sugar in a mortar, triturate briskly, and gradually add the liquorice.*

When freshly prepared, about 3 grains of the mass will contain a grain of iodide of iron.

Dose.—Gr. j to v.

SYRUPUS FERRI IODIDI—Syrup of Iodide of Iron.—*Take of fine iron wire,* 1 *ounce; iodine,* 2 *ounces; refined sugar,* 28 *ounces; distilled water,* 13 *fluid ounces. Prepare a syrup by dissolving the sugar in* 10 *ounces of the water with the aid of heat. Digest the iodine and the iron wire in a flask, at a gentle heat, with the remaining* 3 *ounces of the water, till the froth becomes white; then filter the liquid while still hot into the syrup, and mix. The product should weigh* 2 *pounds* 11 *ounces, and should have the specific gravity* 1·385.

It contains 4·3 *grains of iodide of iron in* 1 *fluid drachm.*

Dose.—Min. xv to lx.

Such a delicate preparation should always be made with distilled water, as the Pharmacopœia directs. The iron wire should be perfectly clean, and the sugar should be the purest. Decomposition is prevented by keeping an iron wire in the solution, and having the bottle well closed.

Therapeutics.—Iodide of iron unites the tonic and chalybeate properties of iron with the alterative and deobstruent action of iodine, and its use is indicated in those cases of scrofula and anæmia, for the individual cure of which these constituents are separately administered. It is apt to cause local irritation if given in too large doses at first, or when too long continued; vomiting, catharsis, diuresis may follow in such cases; also the head symptoms which sometimes arise during the exhibition of chalybeates. It is given as an alterative and tonic to scrofulous children; as an emmenagogue to women of similar constitution, affected with irregularities of the catamenia, leucorrhœa, and other functional and organic diseases of the uterus and ovaries; in chlorosis, in secondary syphilis, in phthisis, in albuminuria, in diabetes, in chronic cutaneous diseases, in debilitated scrofulous patients, &c. Iodide of iron is placed in this group because it is more of an iodine than of a ferruginous medicine; the proportion of iodine to iron being as 4·5 to 1.

IODOFORMUM—Iodoform (CHI_3).—A product of the action of iodine on a mixture of alcohol and solution of carbonate of potassium.

Characters.—Shining, lemon-yellow, crystalline scales; somewhat greasy to the touch ; having a persistent and disagreeable odour and flavour. Very slightly soluble in cold water, more soluble in rectified spirit, soluble in chloroform and ether, readily and entirely soluble in warm ether ; the solution being neutral to litmus paper. When heated, it first melts to a brown liquid, then gives off brown and violet vapours, leaving a black residue, which entirely disappears on continued ignition. Warmed with an alcoholic solution of potash the resulting fluid acidified with nitric acid, iodine is liberated, the mixture acquiring a brown colour, or, when cold, a blue colour, on the addition of mucilage of starch.

Dose.—$\frac{1}{2}$ to 3 grains.

Unguentum Iodoformi—Ointment of Iodoform.—Iodoform, 1 ounce; benzoated lard, 9 ounces. Melt the lard at a low temperature, add the iodoform, and stir together until dissolved and finally cooled.

Suppositoria Iodoformi—Iodoform Suppositories.—Iodoform, 36 grains ; oil of theobroma, 144 grains. Mix in a slightly warmed mortar, and pour into moulds, and then divide into 12 equal parts, Each suppository contains 3 grains of Iodoform.

Therapeutics.—Iodoform is a powerful antiseptic and deodoriser. It possesses little irritant action, though it contains nine-tenths of its weight of iodine. It exercises a marked anæsthetic action. It proves poisonous to the lower animals in smaller doses than iodine. It possesses the general deobstruent and alterative properties of iodine, without having its local inconvenient effects, and has been used in syphilis, scrofula, goitre, and glandular enlargements. Externally, in scaly skin diseases, as an anodyne application to malignant tumours, chancres, ulcers, and to inflammatory, rheumatic, or gouty painful swellings generally. As a suppository in chronic enlargements of the prostate gland, fissure of the rectum, piles, and as vapour in phthisis.

SULPHUR (S=32).—An elementary body found native as virgin sulphur ; also in combination, as sulphides or sulphurets of the metals, &c.

Sulphur Sublimatum—Sublimed Sulphur—*Flowers of Sulphur.*—Prepared from crude or rough sulphur by sublimation.

Characters.—A slightly gritty powder of a fine greenish-yellow colour; without taste, and without odour, unless heated; burning in open vessels with a blue flame and the evolution of sulphurous acid; entirely volatilised by heat.

Sulphur Præcipitatum—Precipitated Sulphur—Milk of Sulphur—*Lac Sulphuris.*

PREPARATION.—*Take of sublimed sulphur,* 5 *ounces; slaked lime,* 3 *ounces; hydrochloric acid, 8 fluid ounces, or a sufficiency; distilled water, a sufficiency. Heat the sulphur and lime, previously well mixed, in a pint of the water, stirring diligently with a wooden spatula; boil for fifteen minutes, and filter. Boil the residue again in half a pint of the water, and filter. Let the united filtrates cool, dilute with* 2 *pints of the water, and, in an open place, or under a chimney, add in successive quantities the hydrochloric acid, previously diluted with a pint of the water, until effervescence ceases and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour in fresh distilled water, and continue the purification by affusion of distilled water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of ammonium. Collect the precipitated sulphur on a calico filter, wash it once with distilled water, and dry it at a temperature not exceeding* 120° F. (48°·9 C.).

Characters.—A greyish-yellow soft powder, free from grittiness, and from the smell of sulphuretted hydrogen. When heated in an open vessel, it burns with a blue flame and the evolution of sulphurous acid is entirely volatilised by heat. Under the microscope it is seen to consist of opaque globules without any admixture of crystalline matter, otherwise it corresponds with sublimed sulphur.

Dose.—Sublimed or precipitated sulphur may be given in doses of 10 to 20 or 30 grains as a stimulant; as a laxative, half a drachm to 2 drachms, or more, in treacle, syrup, milk, or confection.

Confectio Sulphuris—Confection of Sulphur.—*Take of sublimed sulphur,* 4 *ounces; acid tartrate of potash, in powder,* 1 *ounce; syrup of orange peel,* 4 *fluid ounces; tragacanth in powder,* 18 *grains. Rub them well together.*

Dose.—As a laxative, 1 or 2 drachms once or twice a day; a teaspoonful or more morning and evening.

Unguentum Sulphuris—Ointment of Sulphur.—*Take of sublimed sulphur,* 1 *ounce; benzoated lard,* 4 *ounces. Mix thoroughly. For external use* ad lib.

Therapeutics.—Sulphur acts as a stimulant, diaphoretic, and laxative. In small doses (10 to 20 grains), frequently repeated, it stimulates the secreting organs, especially the skin and mucous membranes. In larger doses (a drachm and upwards) it acts as a gentle laxative, producing semi-liquid evacuations without pain or constitutional disturbance; its laxative effects are produced either by increasing the peristaltic action of the bowels, or by increasing the secretion from the mucous membrane of the intestines. A considerable quantity of the sulphur taken internally is carried off unchanged by the bowels, but part of it is absorbed into the circulation, and is eliminated partly in the form of sulphuric acid by the kidneys, and partly as sulphuretted hydrogen by the skin, the latter having the effect of blackening silver articles worn or carried about the person, and of rendering the exhalations from the body very offensive. When applied externally its effects are scarcely observable if the skin be whole, but if it be broken, the sulphur acts as a topical irritant. Internally, sulphur is useful as a laxative in hæmorrhoids, fissure, stricture, prolapsus, and other diseases of the rectum, because in these affections it is desirable to maintain the motions in a soft and liquid condition, so as not to irritate the rectum by the passage of hardened fæces; it also acts locally on the rectal mucous membrane as a stimulant; it has been recommended in phthisis, chronic bronchitis, asthma, hooping cough, and other chest affections; in acute and chronic rheumatism, &c. But its chief use is in many skin diseases, and especially in scabies. In these cases it may be both given internally and applied externally; but for the cure of itch its local application is all that is required. In combination with lime, in the form of a solution of sulphide or sulphuret of calcium (obtained as in the first stage of the preparation of precipitated sulphur), it is said to cure the disease by a single application, the patient being previously and subsequently well washed in a warm bath; but the sulphur ointment is too powerful in most cases, and should be diluted with lard or vaseline, and its odour may be concealed by the addition of Oil of Roses or Benzoic Acid; usually two or three applications are sufficient to cure the disease, applied directly to the affected parts; if the disease is chronic, the secondary eruption must be treated with other remedies. Sulphur fumigations are used in similar cases, also in lead poisoning, &c. For this purpose, the patient is placed in a suitable apparatus, somewhat in the form of a vapour-bath, great care being taken to protect the respiratory organs from the fumes by closing the apparatus round the neck. A deposit of sulphide of lead forms, which is carefully brushed off the skin; and by repeating this process a cure is ultimately effected. Factitious and natural sulphur baths are used for similar purposes.

Sulphurous Acid (SO_2)—Acidum Sulphurosum.—Sulphurous acid gas dissolved in water, and constituting 5 per cent. by weight of the solution; equivalent to 6·4 per cent. of real sulphurous acid —H_2SO_3.

PREPARATION.—*Take of sulphuric acid,* 4 *fluid ounces; wood char-*

coal, broken into small pieces, 1 ounce; water, 2 fluid ounces; distilled water, 30 fluid ounces. Put the charcoal and the sulphuric acid into a glass flask, connected by a glass tube with a wash bottle containing the 2 ounces of water, whence a second tube leads into a pint bottle containing the distilled water, to the bottom of which the gas-delivery tube should pass. Apply heat to the flask until gas is evolved, which is to be conducted through the water in the wash-bottle, and then into the distilled water, the latter being kept cold, and the process being continued until the bubbles of gas pass through the solution undiminished in size. The product should be kept in a stoppered bottle in a cool place.

Characters.—A colourless liquid with a pungent sulphurous odour. Specific gravity 1·025. It gives no precipitate, or but a very slight one, with chloride of barium, but a copious one if solution of chlorine be also added.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

Therapeutics.—Sulphurous acid acts as an irritant, disinfectant, antiseptic, and as a destroyer of certain parasitic vegetable growths which infest the human body. The attention of the profession was, during the years 1866–67, drawn specially to the virtues of this medicine by various observers. It is beneficial when inhaled in phthisis, bronchitis, catarrh, emphysema, &c., or when applied as spray in scarlet fever, diphtheria, putrid sore throat, &c., and as a lotion and as spray in healing sores, weak and specific ulcers, lupus, chilblains, sore nipples, hæmorrhoids, &c. Though we fear its virtues have been overrated by some of its advocates, yet there is reason to believe that sulphurous acid is a good stimulant and antiseptic application to putrid sores generally, since by its deoxidising properties, it defends them from the influence of the oxygen of the air, while it tends, at the same time, to promote healthy action; it is also an expectorant of considerable value. In the latter case, it does not always succeed; but if it does, it acts invariably, after a little, as a sedative and calminative. It is also administered in those cases of dyspepsia and vomiting, in which the ejected matters contain *Sarcinæ ventriculi*, with the view of destroying the vegetable growth in the stomach. Externally, it is used in parasitic skin diseases. Lint soaked in the lotion, and covered with oil silk, may be applied, or the strong solution, with an equal part of glycerine, may be painted upon the part. The fumes of burning sulphur, in combination with steam, in the form of a vapour-bath, are employed for similar purposes, care being taken to protect the respiratory organs from their suffocating properties. Internally, sulphurous acid may be administered in doses of min. x, xxx, dissolved in water.

Externally, it may be applied in lotion of from one of the acid to from two to eight parts of water or glycerine, according to the condition of the sore; or it may be applied in the form of spray, by means of the spray producer, and, in that case, the solution of the Pharmacopœia is suitable, undiluted. For inhalation, it is best to sprinkle a little flowers of sulphur over a clear coal in an iron shovel in the sick room, and inhale the sulphurous-acid fumes as they are formed.

Potassa Sulphurata—Sulphurated Potash—Potassi sulphuretum Hepar sulphuris—Liver of Sulphur.—A mixture of salts of potassium, of which the chief is sulphide.

PREPARATION.—*Take of carbonate of potassium, in powder,* 10 *ounces; sublimed sulphur,* 5 *ounces. Mix the carbonate of potassium and the sulphur in a warm mortar, and having introduced them into a Cornish or Hessian crucible, let this be heated, first gradually, until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin, so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green glass bottle, furnished with an air-tight stopper.*

Characters.—Solid greenish fragments, liver-brown when recently broken, alkaline, and acrid to the taste, readily forming with water a yellow solution, which has the odour of sulphuretted hydrogen, and evolves it freely when excess of hydrochloric acid is dropped into it, sulphur being at the same time deposited. The acid fluid, when boiled and filtered, is precipitated yellow by perchloride of platinum, and white by chloride of barium.

Dose.—2 to 10 grains dissolved in water and sweetened, or in pills; externally, 1 or 2 drachms to a pint of water as a lotion; as an ointment, a drachm to an ounce of lard; as a bath, 4 ounces to 30 gallons of water.

UNGUENTUM POTASSÆ SULPHURATÆ—Ointment of Sulphuretted Potash.

PREPARATION.—*Take of sulphurated potash,* 30 *grains; hard paraffin,* $\frac{1}{4}$ *ounce; soft paraffin,* $\frac{3}{4}$ *ounce. Triturate the sulphurated potash in a porcelain mortar, and gradually add the melted mixture of the hard and soft paraffin, rubbing them together until the ointment is perfectly smooth and free from grittiness.*

Should only be used when recently prepared.

Therapeutics.—Sulphurated potash appears to combine the properties of an alkali with those peculiar to sulphur when administered internally. When applied externally it acts as an irritant. Its effects as an internal remedy are modified by the contents of the stomach; if they be acid, decomposition takes place, sulphuretted hydrogen is evolved, and a mild neutral salt is formed. Usually it acts as a gentle stimulant, exciting the circulation, augmenting the heat of the surface, and giving an impulse to the secreting organs, especially the liver, the skin, and mucous membranes. It is stimulant, diaphoretic, and expectorant; but it is comparatively rarely given internally in this country. In large doses it acts as an acro-narcotic poison, and has on several occasions proved fatal: as such, it produces severe pain in the *primæ viæ*, vomiting, great depression, and convulsions, due to the action of the sulphuretted hydrogen. In smaller quantities it is apt to cause considerable gastric irritation, followed by nausea, vomiting, and hyper-catharsis.

It has been employed internally, for the sake of its general stimulating properties, in certain forms of dyspepsia, in which the mucous follicles are affected, in the latter stage of hooping cough, in chronic rheumatism, in chronic bronchitis, in croup, in catarrhus vesicæ, and in obstinate chronic cutaneous diseases. Externally, in the form of lotion bath, or ointment, it is applied in a variety of chronic skin diseases, in some of which it operates as an irritant, in others by its alkalinity, and in a third class, of parasitic origin, by the action of the sulphur in destroying the organisms. The solution has also been used, by injection into the mucous orifices, for the cure of muco-purulent discharges. The bath is used also for the cure of lead poisoning; they are frequently repeated, so long as the skin continues to be blackened by them. Metallic vessels should be avoided in preparing the bath, those of wood or earthenware being preferable; and care must be taken to protect the patient from the effects of a too free evolution of sulphuretted hydrogen.

CARBON (C=12).

An elementary body found in various states, as in the crystalline condition of the diamond, which is its purest form, in plumbago or graphite, in coke, which is the carbon of coal, and in charcoal, obtained either from animal or vegetable tissues; and all these substances are regarded as merely allotropic forms of the one elementary substance, *Carbon*.

It is now used only in the form of charcoal, of which there are two official varieties, *Carbo Ligni* and *Carbo Animalis*.

Carbo Ligni—Wood Charcoal—Vegetable Charcoal.—Wood charred by exposure to a red heat without access of air.

Characters.—In black, brittle, porous, easily powdered masses, without taste or smell, very light, and retaining the shape and texture of the wood from which it was obtained. When burned at a high temperature with free access of air it leaves not more than about 2 per cent. of ash.

Dose.—20 to 60 grains.

CATAPLASMA CARBONIS—*Charcoal poultice. Take of wood charcoal, in powder,* $\frac{1}{2}$ *ounce; crumb of bread,* 2 *ounces; linseed meal,* $1\frac{1}{2}$ *ounce; boiling water,* 10 *fluid ounces. Macerate the bread in the water for ten minutes near the fire, then mix, and add the linseed meal gradually, stirring the ingredients, that a soft poultice may be formed. Mix with this half the charcoal, and sprinkle the remainder on the surface of the poultice.*

Therapeutics.—Charcoal acts the part of an antacid, disinfectant, deodoriser, &c.; its uses depending upon the power it has of condensing and absorbing gases. Thus it absorbs oxygen readily, and the oxygen thus condensed has an oxidising power similar to that of ozone, and the charcoal gives it off readily when brought into contact with oxidisable substances especially if these be in the form of a gas. Hence it oxidises and decomposes sulphuretted hydrogen readily and decomposing organic substances. It thus acts as a deodoriser and disinfectant. It thus destroys the fœtor of decomposing animal and vegetable matter by its absorbing powers, and also by partially oxidising them. It is administered internally for the relief which it affords in acidity of the *primæ viæ*, and in many disorders dependent upon acrid matters in the alimentary canal; and both internally and externally for the removal of fetid odours. In dyspepsia, gastrodynia, pyrosis, cardialgia, diarrhœa, dysentery, flatulence with constipation, or with hysteria, as a tooth powder, &c., the object in all such cases being either to give relief from acidity, flatulence, or acrid discharges, or to overcome the offensive odour of the breath or of the alvine evacuations. But as charcoal loses its oxidising power when saturated with water the explanation of its action when given internally is unsatisfactory, but, perhaps, as Brunton says, "it acts mechanically by removing mucus, or by stimulating the circulation and peristaltic movement of the stomach and intestine." In large doses it acts as a mild purgative. Externally, in the form of poultice, it is applied to cleanse and deodorise offensive ulcers, gangrene, phagedæna, &c. It is used also in the form of a respirator, as a protection against poisonous gases, also as a filter for the purification of water. For medicinal purposes it should be either recently prepared or be exposed to a high temperature to purify it. It may be given internally, in the form of biscuits or lozenges; but in these cases it should be remembered that charcoal is only a palliative, and should therefore be combined with other remedies suitable for the cure of the disease.

Dose.—10 grains to half an ounce.

Carbo-Animalis—Animal Charcoal—Bone Black.—The residue of bones which have been exposed to a red heat without the access of air. Consists principally of carbon, and phosphate, and carbonate of calcium.

Carbo-Animalis Purifactus—Purified Animal Charcoal.—Bone black from which the earthy salts have been almost wholly removed. Product about 10 per cent.

PREPARATION.—*Take of bone black, in powder,* 16 *ounces; hydrochloric acid,* 10 *fluid ounces; distilled water, a sufficiency. Mix the hydrochloric acid with a pint of the water, and add the bone black, stirring occasionally. Digest at a moderate heat for two days, agitating from time to time; collect the undissolved charcoal on a calico filter, and wash with distilled water till what passes through gives scarcely any precipitate with nitrate of silver. Dry the charcoal, and then heat it to redness in a closely-covered crucible.*

Characters.—A black pulverulent substance, inodorous, and almost tasteless. Tincture of litmus diluted with twenty times its bulk of water, agitated with it and thrown upon a filter, passes through colourless. 10 or 12 grains, well shaken with an ounce of water containing about a fluid drachm of solution of litmus, removes the dissolved colouring matter; the mixture when thrown upon a filter passes through colourless. When burned at a high temperature with a little oxide of mercury and free access of air, it leaves not more than about 2 per cent. of residue.

Therapeutics.—Animal charcoal is chiefly used as a decolorising agent in pharmacy and the arts, and but little as a medicine. But it may be employed in the same cases as wood charcoal. It has been recommended as an antidote in poisoning by certain alkaloids, as morphina, strychnina, aconitina; but it is exceedingly doubtful if it ever does more in such cases than simply entangle, and thus delay the absorption of the poison to a slight extent. Hence the stomach pump or an emetic must be used as soon after as possible. As an antidote the dose is a tablespoonful frequently repeated. Externally, to destroy the fetor of ulcers, &c.

PHOSPHORUS ($P = 31$).—A non-metallic element obtained from bones.

Phosphorus is obtained by the action of sulphuric acid upon calcined bones, and subsequently by distillation with charcoal, &c. The phosphate of lime of the bones is converted by the sulphuric acid into superphosphate and sulphate of lime; and again, the acid phosphate or superphosphate, when heated with charcoal, is changed into phosphate, carbonic oxide, water, and phosphorus.

Characters.—A semi-transparent, colourless, wax-like solid, which emits white vapours when exposed to the air. Specific gravity, 1·77. It is soft and flexible at common temperatures, melts at 110° F. (43°·3 C.), ignites in the air at a temperature a little above its melting point, burning with a luminous flame, and producing dense white fumes. Insoluble in water, but soluble in ether and in boiling oil of turpentine.

OLEUM PHOSPHORATUM—*Phosphorated Oil.—Take of phosphorus and oil of almonds, each a sufficiency. Heat the oil in a porcelain dish to* 300° F. (149° C.), *and keep it at this temperature for about fifteen minutes, then let it cool, and filter it through paper. Put* 4 *fluid ounces of this oil into a stoppered bottle, capable of holding* 4½ *fluid ounces, and add to it* 16 *grains of pure dry phosphorus. Immerse the bottle in hot water until the oil has acquired the temperature of* 180° F. (82°·2 C.), *removing the stopper two or three times to allow the escape of expanded air, then shake the oil and phosphorus until the latter is entirely dissolved. Dose.*—5 *to* 10 *minims.*

Characters.—A clear and colourless, or but slightly-coloured, oil; phosphorescent in the dark.

PILULA PHOSPHORI—*Phosphorus Pill.—Take of phosphorus,* 3 *grains; balsam of tolu,* 120 *grains; yellow wax,* 57 *grains; and curd soap,* 90 *grains. Put the phosphorus and balsam of tolu into a Wedgewood mortar about half-full of hot water, and when the phosphorus has melted, and the balsam has become sufficiently soft, rub them together beneath the surface of the water until no particles of phosphorus are visible, the temperature of the water being maintained at or near* 140° F. (60° C.) *Add now the wax, and as it softens mix it thoroughly with the other ingredients. Allow the mass to cool without being exposed to the air, and keep it in a bottle immersed in cold water. When dispensed every* 2 *grains of the product is to be incorporated with* 1 *grain of the soap; a few drops of rectified spirit being used if necessary to soften the whole.* 3 *grains of the mass so produced, including the soap, will contain* $\frac{1}{30}$*th of a grain of phosphorus. Dose.*—2 *to* 4 *grains.*

Therapeutics.—Phosphorus in over-doses acts as an irritant poison, causing inflammation of the stomach and bowels, and it is not an unfrequent cause of death, both designedly and accidentally. Many children have died after playing with and licking the ends of lucifer matches; others have eaten it with fatal results when strewed as a poison for vermin, and it has been administered with the criminal intention of producing death. The poisonous effects of phosphorus do not follow immediately after it is taken, generally not until several hours have elapsed, and occasionally at the expiration of one or two days. The symptoms, which, when once manifested, run a rapid course, are those of an irritant poison: from the mouth to the stomach there is an acrid burning feeling, with increasing pain in the latter organ; there is intense thirst, nausea, vomiting, and purging; the abdomen becomes tympanitic; there is extreme depression, with a small fluttering pulse, cold clammy skin, and ultimately fatal collapse, occasionally preceded by jaundice and convulsions. The breath, vomited matters, and dejections of the patient have the odour of garlic, they emit white vapours, and in the dark are sometimes luminous. Death usually follows, after intense suffering, in a few days; the extreme periods are said to be four hours in the most rapid, and seventeen days in the most protracted case. One and a half grain of phosphorus has caused death, and possibly less might prove fatal; but, on the other hand, many grains have been taken, and frequently repeated, with impunity. The post-mortem appearances are general fatty degeneration of the tissues or gastro-adenitis.

Workmen who are exposed to the fumes of phosphorus, as in lucifer-match making, are more or less affected by it, caries of the teeth proceeding to necrosis of the jaw being the usual course of the poisonous action in this way. The disease originates in an intense ostitis, which is most probably set up by the phosphoric acid dissolved in the saliva penetrating into the jaw through the cavities of the diseased teeth.

Medicinally, phosphorus acts as a stimulant to the nervous system, and requires extreme caution in its administration to avoid accidents. If given too freely, even in medicinal doses, it is apt to irritate the stomach, and at times to give rise to gastric ulcer. It appears to promote the nutrition of the brain and nervous system and bony skeleton, of which it is a component part, and is therefore of use in certain derangements of the nervous system, especially functional, as in nervous exhaustion, involving either the cerebral or spinal system, whether brought on by mental or bodily causes; also in chronic neuralgia, paraplegia, pemphigus, and in convalescence from illness when there is great debility. According to Dr Wegner's experiments, it also promotes the growth of the bony tissue, hence its use in rickets, osteomalacia, in ununited fractures and subperiosteal excisions. In cases of poisoning give sulphate of copper, 3 grains, in dilute solution, every five minutes until vomiting is induced, as it forms a black phosphide of copper, insoluble and inert (Bamberger); then give sulphate of citrate of magnesia or quickly-acting purgatives; treat the symptoms as they arise, only avoid oil or fatty substances, as they dissolve the phosphorus and promote its absorption.

Acidum Phosphoricum Concentratum.—Concentrated Phosphoric Acid, H_3PO_4, with 33·7 per cent. of water.

PREPARATION.—*Phosphorus*, 413 *grains; nitric acid*, 6 *fluid ounces; distilled water, a sufficiency. The nitric acid, diluted with* 8 *ounces of distilled water, is put into a glass flask, its mouth being connected with a vertical glass condenser. The phosphorus being added, the contents are boiled at such a rate that all condensed products are returned to the flask. When the phosphorus has entirely dissolved, the fluid is concentrated in the flask or porcelain dish until reduced to* 4 *fluid ounces; it is then transferred to a platinum vessel, and evaporation is continued until it is reduced to* 2 *fluid ounces, and orange-coloured vapours are no longer formed. It is then mixed with distilled water, until, when cold, it measures* 3 *fluid ounces, and has a sp. gr. of* 1·15.

Characters.—A colourless syrupy liquid, with a sour taste, and strongly acid reaction. With ammonia-nitrate of silver its diluted solution gives a canary-yellow precipitate soluble in ammonia and in diluted nitric acid. Evaporated, it leaves a residue, which melts at a low red heat, and upon cooling exhibits a glassy appearance. After dilution it is not precipitated by sulphuretted hydrogen passed through the hot solution for a few minutes, nor by chloride of barium, nitrate of silver acidulated with nitric acid, or solution of albumen; and if neutralised by ammonia, and then a slight excess of acetic acid added, oxalate of ammonium does not immediately cause turbidity. When mixed with an equal volume of pure sulphuric acid, and then introduced into solution of sulphate of iron, it does not communicate to it a dark colour. Diluted and mixed with an equal volume of solution of perchloride of mercury and heated, no precipitate is formed. 73·8 grains, by weight, mixed with 180 grains of oxide of lead in fine powder, leave by evaporation a residue (principally phosphate of lead), which after it has been heated to dull redness weighs 215·5 grains.

Dose.—2 to 5 minims freely diluted.

ACIDUM PHOSPHORICUM DILUTUM—Diluted Phosphoric Acid—Phosphoric Acid H_3PO_4.—In solution in water to the extent of 13·8 per cent. by weight, corresponding to 10 per cent. of Phosphoric Anhydride, P_2O_3. (Concentrated phosphoric acid, 3 fluid ounces; distilled water, a sufficiency to form a pint.)

Characters.—A colourless liquid, with a sour taste, of sp. gr. 1·08. 355 grains of it (6 fluid drachms) mixed with 180 grains of oxide of lead in fine powder leave by evaporation a residue (principally phosphate of lead), which after it has been heated to dull redness weighs 215·5 grains.

Dose.—10 to 30 minims and upwards diluted with water.

Therapeutics.—In full doses, phosphoric acid acts as a stimulant, and as an irritant in poisonous doses, but, except by experiment upon animals, little is known of its poisonous effects. In medicinal doses it acts as a tonic, refrigerant, and as a resolvent of phosphatic deposits. Its effects resemble those of dilute sulphuric acid, but it is not so astringent. It has been recommended as a tonic in cases of general debility, atonic dyspepsia, in cases similar to those for which the other mineral acids are employed; in typhus and typhoid fevers; as a refrigerant in colliquative sweating and diarrhœa; in scrofulous affections; in rachitis; in the phosphatic diathesis, and for the removal of phosphatic urinary deposits, in scurvy; as a drink to allay thirst in diabetes, &c.

CLASS II.—CERTAIN ACIDS WHICH MAY BE CONVENIENTLY CONSIDERED TOGETHER.

GROUP I. SULPHURIC, HYDROCHLORIC, NITRIC, NITRO-HYDROCHLORIC, CARBONIC, HYDROSULPHURIC.

ACIDUM SULPHURICUM (H_2SO_4)—Sulphuric Acid—Oil of Vitriol.—An acid produced by the combustion of sulphur and the oxidation and hydration of the resulting sulphurous acid by nitrous and aqueous vapour. It contains about 98 per cent. by weight of real sulphuric acid—H_2SO_4.

Sulphuric acid occurs as a natural product, but only to a limited extent; for commercial purposes it is prepared by admitting simultaneously into suitable leaden chambers sulphurous-acid gas, nitric-acid vapour, and steam. The sulphurous acid gets oxidised by the oxygen of the nitric acid, and the steam uniting with the anhydrous acid resulting, converts it into the ordinary acid—H_2SO_4.

Characters.—A colourless liquid of oily appearance, intensely acid and corrosive. It evolves much heat on the addition of water, and when thus diluted gives a copious precipitate with chloride of barium, sp. gr. 1·843.

It readily abstracts organic impurities, both during its preparation and on subsequent exposure, from the atmosphere, and is, therefore, seldom quite colourless, being usually of a pale straw or somewhat darker colour. It eagerly absorbs moisture from the atmosphere, and thereby rapidly increases in bulk; in consequence of this property of absorbing moisture, it chars most organic substances. The white precipitate with chloride of barium is insoluble in water, acids, and alkalies, and is a characteristic test for sulphuric acid and soluble sulphates.

ACIDUM SULPHURICUM AROMATICUM—*Aromatic Sulphuric Acid—Elixir of Vitriol.—Take of sulphuric acid,* 3 *fluid ounces or* 2419 *grains by weight; rectified spirit,* 36 *fluid ounces; strong tincture of ginger and spirit of cinnamon, of each* 2 *fluid ounces. Mix the sulphuric acid gradually with the spirit, and add the spirit of cinnamon and tincture of ginger, sp. gr.* 0·911. 195 *grains by weight require for neutralisation* 500 *grain measures of the volumetric solution of soda, corresponding to about* 12·5 *per cent. of real sulphuric acid.* 6 *fluid drachms contain about* 37·5 *grains of real acid,* H_2SO_4. *Dose.*—5 *to* 30 *minims.*

ACIDUM SULPHURICUM DILUTUM—*Dilute Sulphuric Acid.—Take of sulphuric acid,* 7 *fluid ounces; distilled water, a sufficiency. Dilute the acid with* 77 *fluid ounces of the water, and when the mixture has cooled to* 60° F. (15°·5 C.), *add more water, so that it shall measure* 83½ *fluid ounces. Or as follows:—Take of sulphuric acid,* 1350 *grains; distilled water, a sufficiency. Weigh the acid in a glass flask, the capacity of which to a mark on the neck is* 1 *pint. Then gradually add distilled water until the mixture, after it has been shaken and cooled to* 60° F. (15°·5 C.), *measures a pint. Dose.*—5 *to* 30 *mins.*

Therapeutics.—Sulphuric acid, in its concentrated state, acts as a powerful corrosive poison, eagerly combining with the organic bases and water of the tissues, corroding the mouth, gullet, and stomach, which are at first white, but ultimately are charred and black. When diluted, it acts, according to its strength, either as a corrosive, or simply as an irritant; or, if still more diluted, as an astringent, tonic, and refrigerant. The strong acid has been used as an escharotic. As a poison, sulphuric acid has frequently caused death, both accidentally and designedly. It has been swallowed by mistake for castor oil, in consequence of its oily appearance. One drachm has caused death in an adult; but as much as 2 ounces, or even more, have been taken, followed by recovery, the poisonous effects being greatest when the stomach is empty. The symptoms of poisoning begin the moment the acid touches the mouth and throat; they consist of intense burning pain in the *primæ viæ*, vomiting of dark-coloured matters, which are acid, contain shreds of disorganised tissues, and more or less of blood; breathing, speaking, and swallowing are performed with great pain and difficulty; the voice is husky, and the breath fetid; the abdomen is swollen and very tender; the skin is cold and clammy, the pulse, small, weak, and frequent; and ultimately fatal collapse ensues. The intellect being unimpaired, the patient feels his dreadful sufferings most keenly and anxiously. Death usually takes place within twenty-four hours, but it may be rapid and sudden, as by suffocation, if the air-passages are much implicated, or by perforation of the stomach; or, on the other hand, death may result from secondary causes several days, weeks, or months afterwards. Stricture of the œsophagus, chronic vomiting, or other secondary cause, may ultimately prove fatal. Antidotes, alkalies, and treat symptoms.

Diluted and aromatic sulphuric acids act as tonics, astringents, and refrigerants, and are employed in a variety of cases. They are given to check profuse perspiration, diarrhœa, and hæmorrhage. They are employed in the night-sweats of phthisis, in combination with opium in ordinary diarrhœa, in the diarrhœa which is premonitory of cholera, and in cholera itself; in passive hæmorrhages from the stomach, bowels, lungs, and uterus; in leucorrhœa and other debilitating discharges; and as refrigerants in fevers. The diluted acids are also employed for the prevention and cure of saturnine poisoning; both internally and topically, in certain skin diseases; in syphilis; in ptyalism; in certain calculous affections, with alkaline urine, &c. When long continued, these, like the other mineral acids, impair the digestive functions; they also injure the teeth, which should be protected, when the dose is taken by making the patient sip the acid through a quill. Its disagreeably acid taste is best covered by sugar. Externally, the concentrated acid has been applied as a cauterant to the bites of rabid animals; to produce a cicatrix for the cure of entropion, &c.

ACIDUM HYDROCHLORICUM.—Hydrochloric Acid Gas, HCl, dissolved in water, and forming about 32 per cent. by weight of the solution—Muriatic Acid, Spirit of Salt.

Preparation.—Take of chloride of sodium, dried, 48 ounces; sulphuric acid, 44 fluid ounces; water, 36 fluid ounces; distilled water, 50 fluid ounces. Pour the sulphuric acid slowly into 32 ounces of the water, and when the mixture has cooled, add it to the chloride of sodium, previously introduced into a flask having the capacity of at least 1 gallon. Connect the flask by corks and a bent glass tube with a three-necked wash-bottle, furnished with a safety-tube, and containing the remaining 4 ounces of the water; then, applying heat to the flask, conduct the disengaged gas into a second bottle containing the distilled water, by means of a bent tube dipping about half an inch below the surface; and let the process be continued until the product measures 61 ounces, or the liquid has acquired a specific gravity of 1·16. The bottle containing the distilled water must be kept cool during the whole operation.

Characters.—A nearly colourless and strongly acid liquid, emitting white vapours having a pungent odour, sp. gr. 1·160. It gives, with nitrate of silver, a curdy white precipitate, soluble in excess of ammonia, insoluble in nitric acid.

ACIDUM HYDROCHLORICUM DILUTUM—*Dilute Hydrochloric Acid.—Take of hydrochloric acid,* 8 *fluid ounces; distilled water, a sufficiency. Dilute the acid with* 16 *ounces of the water, then add more water, so that at a temperature of* 60° F. (15°· 5 C.), *it shall measure* 26½ *fluid ounces. Dose.*—10 *to* 30 *mins.*

Concentrated hydrochloric acid acts as a powerful corrosive poison, but poisoning by it is comparatively rare, the symptoms resemble those of poisoning by sulphuric acid, and their treatment is the same. It has been recommended as a topical application in cases of hospital gangrene, gangrenous stomatitis, scrofulous ulcers, and others of feeble vitality, aphthous, mercurial, and other ulcers of the mouth, tongue, and tonsils, diphtheria, malignant or putrid sore throat, warts, &c. In these cases it is applied either by means of a pointed piece of wood or a sponge, and of a strength varying with the circumstances. The diluted acid is administered internally as an alterative, tonic, and antalkaline, and has been used in cases of atonic dyspepsia, general debility, scrofula, phthisis, combined with a vegetable bitter in diseases of the liver, whether of scrofulous or specific origin, urinary affections with phosphatic deposits, diabetes, secondary syphilis, typhus and typhoid fevers, scarlatina, chronic hooping cough, &c., and as a gargle in ulcerated sore throat.

ACIDUM NITRICUM—Nitric Acid—Aqua Fortis.

An acid prepared from nitrate of potassium or nitrate of sodium by distillation with sulphuric acid and water, and containing 70 per cent. by weight of real nitric acid (HNO_3). The reaction is $KNO_3 + H_2SO_4 = KHSO_4 + HNO_3$.

ACIDUM NITRICUM DILUTUM—*Diluted Nitric Acid.*—*Take of nitric acid,* 6 *fluid ounces; distilled water, a sufficiency. Dilute the acid with* 24 *fluid ounces of the water, then add more water, so that at a temperature of* 60° F. (15°·5 C.) *it shall measure* 31 *fluid ounces. Dose.*—10 *to* 30 *mins.*

ACIDUM NITRO-HYDROCHLORICUM DILUTUM—*Diluted Nitro-Hydrochloric Acid.*—*Take of nitric acid,* 3 *fluid ounces; hydrochloric acid,* 4 *fluid ounces; distilled water,* 25 *fluid ounces. Mix the acids, and allow them to remain for twenty-four hours in a bottle, the mouth of which is partially closed; then add the water in successive portions, shaking the bottle after each addition, and preserve the mixture in a stoppered bottle, sp. gr.* 1·07. *Dose.*—10 *to* 30 *mins.*

Therapeutics.—Concentrated nitric acid acts as a powerful corrosive poison, the symptoms of which and their treatment resemble those mentioned under sulphuric acid. The strong acid is used externally as a caustic application to phagedenic ulcers, hospital gangrene, poisoned wounds, the bites of rabid animals and poisonous vermin, condylomata, chancres, hæmorrhoids, warts, corns, carious bones, chilblains, &c. Internally, the diluted acid has been employed as an alterative, tonic, refrigerant, and antalkaline. It has been recommended in syphilitic cases in which mercury has either been previously given or is not desirable, and in rheumatic cases complicated with syphilis under similar circumstances; in chronic affections of the liver and spleen; in diabetes; in atonic dyspepsia, especially with a vegetable bitter; in urinary affections with phosphatic deposits; in intermittent fevers; and also in typhus and typhoid fevers; in hooping-cough; in cholera, dysentery, and diarrhœa. It has been also injected into the bladder in cases of chronic inflammation, and for the solution of phosphatic calculi. In the form of liniment it has been used in some skin diseases and in alopœcia; and as a gargle in throat affections. It is also used as a fumigating and disinfecting agent. Its vapours, when incautiously inhaled, induce most intense capillary bronchitis. This has led to fatal results on several occasions.

Nitro-hydrochloric acid in the concentrated form (*Aqua Regia*) is not official, but it is occasionally used as a caustic. The diluted nitro-hydrochloric acid is employed, both internally and in the form of bath, as a tonic and alterative, and as a topical stimulant. It has been employed in chronic affections of the liver and spleen, in jaundice, and in dropsies proceeding from derangement of these organs, in which cases it is given internally, applied as a lotion to the region of the liver, as well as used as a pediluvium ; in syphilis, both internally, externally, and as a gargle ; in urinary affections, as in the phosphatic, oxalic acid, and cystic oxide diatheses ; in gangrene of the lungs, as an antiseptic ; in scarlatina, both internally and as a gargle ; as a lotion in certain skin diseases, acne rosacea ; in cholera ; in epilepsy ; in atonic dyspepsia ; in chronic rheumatism ; in indolent ulcers ; in the scrofulous cachexia, &c.

Acidum Carbonicum (CO_2) (not official)—Carbonic Acid—Carbonic Anhydride—Choke-Damp—at the ordinary temperature of the atmosphere, is a colourless, transparent, inodorous, and sourish gas, but by pressure may be solidified. It is heavier than the atmosphere, its specific gravity being 1·525, and in some situations, as in the *Grotto del Cane*, near Naples, and in the Valley of Poisons, in Java, it is constantly present in such quantity as to cause the death of animals exposed to its influence ; and but for the diffusive property of gases, this poisonous substance would gravitate to the surface of the earth and put an end to vitality. It has an acid reaction, is readily absorbed by solutions of potash and lime, and to a certain extent in water. The aqueous solution of carbonic acid is feebly and transiently acid. Under pressure, water may be made to absorb a considerable quantity, the excess of gas escaping forcibly on the removal of the pressure. Carbonic-acid gas may be obtained by decomposing any of the carbonates by means of a strong acid. Undiluted, it is irrespirable, producing spasmodic closure of the glottis and asphyxia ; when diluted, it acts upon the brain, producing drowsiness, a feeling of fulness and tension in the head, throbbing headache, impaired vision, tinnitus aurium, giddiness, loss of muscular power, somnolency, stupor or coma, with lividity of countenance, general venous congestion, and sometimes delirium and convulsions. It often proves fatal in mines (Choke-Damp), brewers' vats, wells, caverns, &c. The indications of treatment are to aërate the blood by exposing the patient to free air, to produce respiratory effects by shocks of galvanism or cold affusion, or artificially if necessary, and to relieve congestion by moderate general or local blood-letting. Medicinally, carbonic-acid gas has been used as a general anæsthetic, and also as a local anæsthetic to afford relief from the pain occasioned by cancerous and other affections of the uterus, cancerous wounds, sciatica, and other neuralgic affections, dysentery, and diseases of the rectum, &c. By inhalation it has been used with great success in the treatment of spasmodic asthma, and of chronic bronchitis and emphysema. It has been used injected locally to produce premature labour. Internally, in the form of *aqua acidi carbonici*, soda water, potash water, acidulous mineral waters, &c., carbonic acid is given to subdue nausea and vomiting, to allay irritability of the stomach, to obviate the tendency to certain urinary deposits, &c. Effervescing drinks are suitable vehicles for the administration of many medicines which irritable stomachs will not bear when given in any other manner.

Acidum Hydrosulphuricum (H_2S) (not official)—Hydro-Sulphuric Acid—Sulphuretted Hydrogen.—Prepared by the action of dilute sulphuric acid upon iron sulphide—FeS. $FeS + H_2SO_4 = FeSO_4 + H_2S$.

Sulphuretted hydrogen, at the ordinary temperature of the atmosphere, is a colourless gas, of a nauseous rotten-egg-like odour, inflammable, feebly and transiently reddening litmus paper, and soluble in water. The solution of sulphuretted-hydrogen gas in water is colourless, and emits an offensive rotten-egg-like odour. It is useful as a test, in consequence of its strong tendency to interchange with metallic oxides forming water and metallic sulphides—the latter of which, being in several instances insoluble in water, afford characteristic precipitates. Sulphuretted hydrogen is poisonous even when largely diluted with atmospheric air ; it is produced in sewers, and by the putrefaction of animal tissues. Chlorine decomposes the gas, and therefore chloride of lime, or solutions of chlorine, may be used as antidotes. Sulphuretted hydrogen occurs also in the class of sulphurous mineral waters previously mentioned.

Group II. Acetic, Tartaric, Citric, Oxalic, Boric, Lactic, Hydrobromic, Chromic.

ACIDUM ACETICUM GLACIALE ($HC_2H_3O_2$)—Glacial Acetic Acid—Monohydrated Acetic Acid.

Concentrated acetic acid, containing nearly 99 per cent. of real acid, $HC_2H_3O_2$.

Prepared by treating fused acetate of soda with sulphuric acid and distilling.

Characters.—It crystallises when cooled to 34°, and remains crystalline until the temperature rises above 60° F. (15°·5 C.). Specific gravity 1·058, and this is increased by adding 10 per cent. of water. At the mean temperature of the air it is a colourless liquid, with a pungent acetous odour.

Therapeutics.—Glacial acetic acid acts as an irritant, rubefacient vesicant, and escharotic. It is but seldom used even externally, and never internally, except in the form of aromatic vinegar, the stronger acetic acid being generally employed in its stead. It is sometimes used to destroy corns, warts, &c.; and, painted over the part as a vesicant, in cases in which there is intolerance of cantharides.

ACIDUM ACETICUM—Acetic Acid—Purified Pyroligneous Acid.—An acid liquid prepared from wood by destructive distillation, and subsequent purification; 100 parts by weight contain 33 parts of real acetic acid, $HC_2H_3O_2$.

Beech, oak, birch, and other hard and non-terebinthinous woods are employed in the preparation of acetic acid. They are first dried, and then heated in iron retorts. The products are partly gaseous, which are carried into the furnace to serve as fuel, and partly liquid, amongst which is impure acetic acid. In order to purify this, it is saturated either by soda or by chalk, whereby the acetate of soda or lime is formed. This salt is heated sufficiently to drive off the tarry matters which accompanies the acid, but carefully, so as not to decompose the salt itself. The acetate is next purified by repeated solution and crystallisation, and finally it is distilled with diluted sulphuric acid, which, by seizing upon the base to form sulphate of soda or lime, allows the acetic acid to pass over, and this is again purified by redistillation.

Characters.—A colourless liquid, having a strong acid reaction and a pungent odour. Sp. gr. 1·044.

ACIDUM ACETICUM DILUTUM—*Diluted Acetic Acid.—Take of acetic acid*, 1 *pint; distilled water*, 7 *pints; mix. Sp. gr.* 1·006.

OXYMEL—*Oxymel.—Take of clarified honey*, 40 *ounces; acetic acid*, 5 *fluid ounces; distilled water*, 5 *fluid ounces. Liquefy the honey by heat, and mix with it the acetic acid and water.*

Dose.—Of the diluted acid, 1 drachm or more, sufficiently diluted; of oxymel, 1 to 3 or 4 drachms, added to gargles or cough mixtures.

Therapeutics.—Strong acetic acid is occasionally used externally as a rubefacient, vesicant, and escharotic; to destroy morbid growths, venereal vegetations, warts, corns, &c.; to remove nævi; to produce vesication in cases in which there is intolerance of cantharides; as an application to tinea capitis, psoriasis, &c. It dissolves cantharidine, and enters into the official *Liquor Epispasticus.* Internally, the strong acid acts as a powerful corrosive poison, the symptoms and treatment resembling those of poisoning by the mineral acids. The diluted acid acts as a refrigerant and astringent, and may be used in the same manner as vinegar, both internally and also externally, either in form of lotion or for sponging the body in fevers and colliquative sweating. Oxymel is used as an adjunct to astringent gargles, and is given internally as an expectorant and diaphoretic. Dilute acetic acid is also employed for fumigation in the sick-room.

ACETUM—Vinegar.—An acid liquid prepared from a mixture of malted and unmalted grain by the acetous fermentation.

Vinegar may be obtained from a variety of substances, and varies in its quality according to its source. In this country it is prepared from malt, beer, cider, sugar dissolved in water, with the addition of a little brandy and yeast, and from other sources ; but in France it is prepared from wines by simply exposing them freely to the influence of the atmosphere, adding a little vinegar to start the process. *Acetification*, as the process is termed, consists in the conversion of alcohol into aldehyd and water, and the former of these into hydrated acetic acid : thus, C_2H_6O (alcohol), by the abstraction of two atoms of hydrogen, by the action of the oxygen of the atmosphere, becomes C_2H_4O (aldehyd) $+H_2O$ (water), and the aldehyd, abstracting another equivalent of oxygen from the atmosphere, becomes hydrated acetic acid : $C_2H_4O+O=C_2H_4O_2$. The vinegar of commerce consists of this acetic acid diluted and contaminated with organic impurities.

Characters.—A liquid of a brown colour and peculiar odour, sp. gr. 1·017 to 1·019.

Dose.—One to several drachms, either alone or diluted. As a drink, well diluted, *ad libitum.*

Therapeutics.—Its action and uses are identical with those of the dilute acetic acid.

ACIDUM LACTICUM—Lactic acid, $HC_3H_5O_3$—containing 75 per cent. of lactic acid in water prepared by the action of a peculiar ferment on solution of sugar, and subsequent purification of the product.

Characters.—A colourless syrupy liquid, inodorous, strong acid taste and acid reaction, sp. gr. 1·21. Miscible in all proportions with water, rectified spirit, and ether, nearly insoluble in chloroform ; on being heated to about 350° F. (176°·7 C.), it yields inflammable gases, and the residue chars, and finally almost entirely disappears. A solution in about 10 parts of water neutralised by ammonia is not precipitated by sulphydrate of ammonium. Not more than a faint opalescence is produced with chloride of barium, nitrate of silver, or oxalate of ammonium, nor when boiled with excess of Fehling's solution is any precipitate formed. 120 grains require for neutralisation 1000 grain measures of volumetric solution of soda.

ACIDUM LACTICUM DILUTUM.—Dilute Lactic Acid (lactic acid, 3 fluid ounces; distilled water, sufficient to produce 1 pint) sp. gr. 1·04. 800 grains by weight require for neutralisation 1000 grain measures of the volumetric solution of soda.

Therapeutics.—It has been employed in diabetes with good results in some cases, and has also been recommended in dyspepsia instead of hydrochloric acid, but its principal use is in diabetes.

Dose of the dilute Acid.—½ fl. drm. to 2 fl. drm.

ACIDUM TARTARICUM ($H_2C_4H_4O_6$)—Tartaric Acid.—A crystalline acid prepared from the acid tartrate of potash.

Preparation.—Take of acid tartrate of potash, 45 ounces; distilled water, a sufficiency; prepared chalk, 12½ ounces; chloride of calcium, 13½ ounces; sulphuric acid, 13 fluid ounces. Boil the acid tartrate of potash with 2 gallons of the water, and add gradually the chalk, constantly stirring. When the effervescence has ceased, add the chloride of calcium dissolved in 2 pints of the water. When the tartrate of lime has subsided, pour off the liquid, and wash the tartrate with distilled water until it is rendered tasteless. Pour the sulphuric acid, first diluted with 3 pints of the water, on the tartrate of lime, mix thoroughly, boil for half an hour, with repeated stirring, and filter through calico. Evaporate the filtrate at a gentle heat until it acquires the specific gravity of 1·21, allow it to cool, and then separate and reject the crystals of sulphate of lime which have formed. Again evaporate the clear liquor till a film forms on its surface, and allow it to cool and crystallise. Lastly, purify the crystals by solution, filtration (if necessary), and recrystallisation.

Characters.—In colourless crystals, the primary form of which is the oblique rhombic prism, it has a strongly acid taste, and is readily soluble in water and in rectified spirit. When to either solution not too much diluted, a little acetate of potash is added, a white crystalline precipitate is formed. The crystals are inodorous and permanent in the atmosphere.

Therapeutics.—Tartaric acid in large doses acts as an irritant poison, and death has followed the administration of 1 ounce dissolved in half a pint of warm water. The symptoms and treatment resemble those of poisoning by oxalic acid. Medicinally, it is used as a refrigerant drink, well diluted with water, in febrile and inflammatory cases. It has been recommended as a solvent of mucus in the alimentary canal in certain cases of dyspepsia; but it is chiefly used to prepare effervescing draughts, for which it is cheaper but not so agreeable as citric acid. It enters into the constitution of *Seidlitz Powders.*

Dose.—10 to 20 or 30 grains dissolved in water and sweetened. To prepare effervescing draughts, 29 grains of the crystallised acid will saturate 27 grains of crystallised bicarbonate of potash, 22 grains of crystallised bicarbonate of soda, 33½ grains of crystallised carbonate of soda, and 15½ grains of hydrated sesquicarbonate of ammonia.

ACIDUM HYDROBROMICUM DILUTUM—Dilute hydrobromic acid.—An aqueous solution of 10 per cent. of gaseous or real hydrobromic acid (HBr).

Preparation.—Take 1 fluid ounce of bromine, and of distilled water and sulphuretted hydrogen of each a sufficiency. A current of sulphuretted hydrogen is passed into a mixture of bromine and water until the red colour has disappeared. The fluid is filtered and distilled, the first portion of the distillate being rejected. Dilute the distilled acid with water until it has a sp. gr. at 60° F. (15°·5 C.) of 1·077, and preserve it in glass-stoppered bottles.

Characters.—A colourless inodorous liquid, with a sour taste and acid reaction, completely volatilised by heat. Chlorine water liberates bromine, colouring the fluid yellow. With nitrate of silver it yields a white curdy precipitate insoluble in nitric acid and only sparingly soluble in solution of ammonia. No precipitate with chloride of barium. 810 grains by weight require for neutralisation 1000 grain measures of the volumetric solution of soda.

Therapeutics.—It is sometimes employed instead of the bromide of potassium, but is much less powerful as a sedative in epilepsy and insomnia. It is a useful solvent for quinine, and it is said to diminish the cerebral symptoms, but in other cases its action is not very decided.

Dose.—15 min. to 50 min.

ACIDUM CITRICUM ($H_3C_6H_5O_7H_2O$)—Citric Acid.—A crystalline acid obtained from lemon juice, or from the juice of the fruit of *Citrus Limetta* (Risso), the Lime.

Preparation.—Take of lemon juice, 4 pints; prepared chalk, 4½ ounces; sulphuric acid, 2½ fluid ounces; distilled water, a sufficiency. Heat the lemon juice to its boiling point, and add the chalk by degrees till there is no more effervescence. Collect the deposit on a calico filter, and wash it with hot water till the filtered liquor passes from it colourless. Mix the deposit with a pint of distilled water, and gradually add the sulphuric acid, previously diluted with a pint and a half of distilled water; boil gently for half an hour, keeping the mixture constantly stirred. Separate the acid solution by filtration, wash the insoluble matter with a little distilled water, and add the washings to the solution. Concentrate this solution to the density of 1·21 then allow it to cool, and, after twenty-four hours, decant the liquor from the crystals of sulphate of lime which will have formed; further concentrate the liquor till a film forms on its surface, and set it aside to cool and crystallise. Purify the crystals, if necessary, by recrystallisation.

Characters.—In colourless crystals, of which the right rhombic prism is the primary form, very soluble in water, less soluble in rectified spirit, and insoluble in pure ether. The crystals dissolve in three-fourths of their weight of cold and in half their weight of boiling water. The diluted aqueous solution has an agreeable acid taste. When the solution is made, by dissolving 34 grains of the acid in 1 ounce of water, it resembles lemon juice in its strength and in the nature of its acid properties, and, like lemon juice, it undergoes decomposition and becomes mouldy by keeping.

Therapeutics.—Citric acid is occasionally used as a substitute for fresh lemon juice, to which it is inferior as a refrigerant and anti-scorbutic. But it is chiefly used in the preparation of effervescing draughts, and enters into the constitution of the officinal citrates.

Dose.—10 to 20 or 30 grains dissolved in sufficient water and sweetened. To prepare effervescing draughts, 17 grains (equal to half a fluid ounce of fresh lemon juice) will saturate 25 grains of bicarbonate of potash, 20 grains of bicarbonate of soda, 20 grains of carbonate of potash, 35 grains of carbonate of soda, 15 grains of carbonate of ammonia, and 13 grains of carbonate of magnesia.

ACIDUM CHROMICUM—Chromic Acid—Anhydrous Chromic Acid—Chromic Anhydride, CrO_3.

Preparation.—It is obtained by the action of strong sulphuric acid on a concentrated solution of bichromate of potassium.

Characters.—Crimson acicular crystal, very deliquescent, inodorous. Corrosively caustic to the skin. Soluble in water, yielding a deep orange solution. Warmed with hydrochloric acid chlorine is evolved. If brought in contact with alcohol, glycerine, ether, &c., an explosion may occur.

Liquor Acidi Chromici.—Solution of Chromic Acid (chromic acid, 1 ounce; distilled water, 3 fluid ounces). An orange red, inodorous, caustic, strongly acid fluid, containing the equivalent of 25 per cent. of anhydrous chromic acid, CrO_3, or 29·5 per cent. of real chromic acid, H_2CrO_4. Sp. gr. 1·185.

Therapeutics.—This acid, on account of its oxidising power, is a deodoriser and disinfectant. It is sometimes employed as a caustic in venereal disease or in condylomata, one part to four of water, and in ulceration of tongue and pharynx one in forty.

ACIDUM OXALICUM ($H_2C_2O_42H_2O$) (not official)—Oxalic Acid.

Oxalic acid crystallises in transparent four-sided prisms, which are readily soluble in water and alcohol, are intensely sour, effervesce in dry air, fuse in their water of crystallisation at 212°, and sublime, without leaving any residue, at 320°. Oxalic acid has been sold in mistake for sulphate of magnesia or *Epsom salts*, and for sulphate of zinc or *white vitriol;* but oxalic acid may be distinguished from the others by the following characters:—1. It is entirely volatised by heat, if pure; the others are fixed, after parting with their water of crystallisation. 2. Oxalic acid is intensely sour; sulphate of zinc much less so, and sulphate of magnesia neutral and bitter. 3. Nitrate of silver precipitates white oxalate of silver, which is soluble in cold nitric acid. 4. With solution of sulphate of lime, oxalic acid gives a white precipitate, which is soluble in nitric acid, but insoluble in the vegetable acids. 5. By evaporating a solution containing oxalic acid, the crystals bearing their distinguishing characters may be obtained.

Dose.—Half a grain to 1 or 2 grains dissolved in water and sweetened. As a drink, 5 grains, dissolved in half a pint of water, sweetened, may be given in the twenty-four hours; or in the form of lemonade.

Therapeutics.—Oxalic acid in over-doses acts as a virulent poison, occasioning death sometimes within a few minutes, frequently within an hour, but occasionally after a longer interval, according to the quantity taken, the amount of fluid taken with it, and the state of the stomach at the time with regard to food. Death has followed the administration of a drachm of the acid, and recoveries have taken place after half an ounce has been swallowed. The symptoms immediately following the administration of a large dose are—an intensely sour taste, a burning sensation in the œsophagus and stomach, a choking or suffocating feeling of constriction in the throat, and great tenderness of the abdomen; this is usually, but not invariably, followed by vomiting of dark-greenish or brownish coloured matters, mixed with blood, and very acid. The skin is cold and clammy; the pulse small, weak, and frequent; the countenance anxious and expressive of great pain; and ultimately fatal collapse ensues, occasionally preceded by convulsions. If the patient recover from the immediate consequences, he may subsequently suffer from great pain in the *primæ viæ*, difficulty of swallowing, intense thirst, vomiting, &c. Medicinally, oxalic acid has been recommended as a refrigerant, sedative, and antiphlogistic, and has been given in acute inflammatory affections of the mucous membranes, especially of the stomach and respiratory organs; it has been given, also, as a refrigerant drink in febrile. Antidotes—chalk, magnesia or lime water: the alkalies, and their carbonates form poisonous salts with oxalic acid, and are therefore inadmissible.

ACIDUM BORICUM (H_3BO_3)—Boracic Acid.

A weak acid obtained by the action of sulphuric acid on borax, and by the purification of native boric acid.

Boracic acid occurs in white scaly crystals of a pearly lustre, which are inodorous, of a slightly acid and bitter taste; are soluble in hot water and alcohol, less soluble in cold water, the solutions having a feebly acid reaction. The crystals are unctuous to the touch, and are fused by a red heat into a colourless transparent glass. The alcoholic solution burns with a green flame. The aqueous solution should not yield more than a faint opalescence, with chloride of barium, nitrate of silver, or oxalate of ammonium; nor afford any precipitate with sulphydrate of ammonium; nor give a strong persistent yellow tinge to a spirit flame or air gas flame.

Official Preparation.—*Unguentum Acidi Borici* (*boric acid*, 2½ *ounces; soft paraffin*, 10 *ounces; hard paraffin*, 5 *ounces*).

Therapeutics.—It was formerly called "Homburg's Sedative Salt," and was employed as a sedative in cerebral affections, in cardialgia, &c., but has now almost disappeared from medical practice. It has, however, lately come into pretty general use in surgery as an antiseptic dressing for wounds. It acts as an excellent non-irritating antiseptic, whereas carbolic acid is a strongly stimulating one. It is employed—(1) in the form of a saturated aqueous solution, in which the lint employed to dress the wound is steeped; (2) as an ointment; and (3) to prepare a dry dressing formed of lint which has been immersed in a hot saturated solution of the acid and then dried.

Dose of boric acid, 5 grains to 30 grains.

CLASS III.—METALS.

Group I. Metals of the Alkalies—Potassium, Sodium, and Lithium, with which it is convenient to place Ammonium.

POTASSIUM (K = 39)—Potassium—Kalium—is a bluish-white brittle metal, floats on water, and readily oxidises when exposed to the air. It is abundantly distributed throughout nature in combination with the acids, earths, and halogens. It is the metallic base of

Potassa Caustica—Hydrate of Potassium (KHO) containing some impurities — Potassæ Hydras — Potassa Fusa—Hydrate of Potash.

Preparation.—*Take a solution of potash, 2 pints. Boil down the solution of potash rapidly in a silver or clean iron vessel until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles.*

Characters.—In hard white pencils, very deliquescent, powerfully alkaline and corrosive. A watery solution acidulated by nitric acid gives a yellow precipitate with perchloride of platinum, and only scanty white precipitates with nitrate of silver and chloride of barium.

Therapeutics.—Caustic potash is a powerful escharotic and corrosive irritant poison. The symptoms of poisoning consist of the disagreeable acrid and caustic taste of the potash ; burning pain in the mouth, throat, œsophagus, and stomach ; generally vomiting of dark-brown coloured matters, which are alkaline, and contain blood and shreds of mucous membrane ; great tenderness of the abdomen, with colicky pains and purging ; skin cold and clammy ; pulse small, weak, and frequent ; hiccough, &c. The mouth and fauces are tense, red, and corroded. Sometimes the larynx is implicated, and death is caused by asphyxia. Death may take place by collapse within a few hours or days of the poisoning, or subsequently by exhaustion. Antidotes—dilute acids and demulcents. Medicinally, caustic potash is used only externally as an escharotic to form issues, to destroy morbid growths, to remove nævi, to obliterate varicose veins, to arrest hospital gangrene, to open deep-seated and chronic abscesses and bubos, to overcome strictures of the urethra, to destroy hypertrophied and ulcerated portions of the os and cervix uteri, &c.

The chief hindrance to the application of caustic potash is its deliquescence; but its action may be limited by protecting the surrounding parts with cotton wadding soaked in vinegar. To obviate this, it has been prepared in a variety of ways:—*Potassa cum calce* consists of equal parts of lime and caustic potash; it is less energetic than the pure caustic, but is also less troublesome to use. *Vienna Paste* is a modification of the above, made by powdering together potassa cum calce and quicklime in the proportions of five of the former to six of the latter; the powder is made into a paste with spirit when required.

Liquor Potassæ—Solution of Potash—Caustic Potash dissolved in water.

PREPARATION.—*Take of carbonate of potassium,* 1 *pound; slaked lime,* 12 *ounces; distilled water,* 1 *gallon. Dissolve the carbonate of potassium in the water; and having heated the solution to the boiling-point in a clean iron vessel, gradually mix with it the slaked lime; and continue the ebullition for ten minutes, with constant stirring. Then remove the vessel from the fire; and when, by the subsidence of the insoluble matter, the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralising power.*

Dose.—10 minims up to 1 or 2 drachms, largely diluted in aromatic or bitter infusions, milk, mistura amygdalæ, &c.

Therapeutics.—Concentrated liquor potassæ acts as a corrosive irritant poison, the symptoms and treatment resembling those of poisoning by caustic potash. Medicinally, liquor potassæ is used as an antacid, antilithic, lithontriptic, alterative, diuretic, liquefacient, resolvent, &c. It has been recommended in scrofula; in syphilis; in acute and chronic rheumatism; in dyspepsia, accompanied by acidity, cardialgia, &c.; in a variety of skin diseases; in serous inflammations; in chronic bronchitis and catarrh; in obesity; in certain calculous affections and irritable conditions of the urinary organs; in gonorrhœa and in strangury, &c. Externally, well diluted, it is employed as a lotion in chronic skin diseases, and occasionally as an escharotic, applied in the concentrated form to the bites of rabid and poisonous animals, &c.

Potassii Carbonas (K_2CO_3, with about 16 per cent. of water of crystallisation)—Carbonate of Potash.—It is made by lixiviating and purifying the pearl ashes of commerce.

Characters.—A white crystalline powder, alkaline and caustic to the taste, very deliquescent, readily soluble in water, but insoluble in spirit, effervescing with diluted hydrochloric acid, and forming a solution with which perchloride of platinum gives a yellow precipitate.

Dose.—5 or 10 to 20 grains, sufficiently diluted; as a lotion, half a drachm to a drachm in a pint of water; as a bath, 1 to 3 ounces in 20 to 30 gallons of water; as an ointment, half a drachm to an ounce of simple ointment.

Therapeutics.—Carbonate of potash in over-doses acts as a corrosive poison, the symptoms and treatment resembling those of poisoning by caustic potash. Medicinally, it is an antacid, diuretic, alterative, and antilithic. It is less caustic than potash, and may therefore be administered more freely; but in consequence of its disagreeable taste and irritant action, it is comparatively little used. It has been employed in cases similar to those for which the bicarbonate and solution of potash are recommended, and occasionally in the form of effervescing draughts. It passes into the urine unchanged. Externally, in the form of lotion, bath, or ointment, it has been used in skin diseases, more especially in the various forms of eczema.

Potassii Bicarbonas ($KHCO_3$)—Bicarbonate of Potassium.

PREPARATION.—*This salt may be obtained by saturating a strong aqueous solution of carbonate of potassium with carbonic-acid gas and recrystallising the separated salt.*

Characters.—Colourless right rhombic prisms, not deliquescent, of a saline feebly alkaline taste, not corrosive. Diluted hydrochloric acid causes strong effervescence, forming a solution with which perchloride of platinum gives a yellow precipitate.

Dose.—10 grains to half a drachm, sufficiently diluted; or in the form of effervescing draughts, in the proportion of 20 grains of the bicarbonate to 14 grains of citric acid, or 3½ fluid drachms of fresh lemon juice.

Therapeutics.—Bicarbonate of potash acts as an antacid, diuretic, alterative, and antilithic; it has none of the corrosive properties of potash and its carbonate. It is employed in dyspepsia with acidity of the stomach, cardialgia, most usually in combination with a bitter tonic infusion, as infusion of gentian, &c. Largely diluted, it is employed in the lithic acid cachexia to maintain uric acid in solution, also to allay irritability of the bladder and kidneys, and in such cases is commonly combined with pareira, bucchu, or uva ursi, in the alkaline treatment of acute and chronic rheumatism, and in cases similar to those for which potash and its carbonate are recommended. The bicarbonate and carbonate of potash and soda are found more suitable than the solutions of the caustic alkalies for prescribing along with vegetable solutions, as the latter are apt to be decomposed by continued contact with caustic alkali, while they may be kept for any length of time unaffected by the carbonates.

Liquor Potassæ Effervescens—Effervescing Solution of Potash—Potash Water.

PREPARATION.—*Take of bicarbonate of potash,* 30 *grains; water,* 1 *pint. Dissolve the bicarbonate of potash in the water, and filter the solution; then pass into it as much pure washed carbonic-acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of* 7 *atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.*

Characters.—Effervesces strongly when the containing vessel is opened, carbonic-acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste.

The actions and uses of this preparation are the same as those of the bicarbonate. It is, however, a valuable addition to the Pharmacopœia, inasmuch as it affords a fixed standard strength for effervescing solutions of potash, which vary much as obtained from different manufacturers.

Potassii Sulphas (K_2SO_4)—Sulphate of Potassium.

It is obtained from the acid sulphate ($KHSO_4$) formed in the preparation of nitric acid from sulphuric acid and nitre. The acid sulphate is dissolved in water and treated with slaked lime until the solution is alkaline. Excess of lime is removed by the addition of carbonate of potassium, and the fluid is then rendered neutral or slightly acid by diluted sulphuric acid. The sulphate of potassium is allowed to crystallise out after evaporation.

Characters and Tests.—In colourless hard six-sided prisms, terminated by six-sided pyramids; decrepitates strongly when heated; sparingly soluble in water; insoluble in alcohol. The aqueous solution is neutral to test paper, gives no precipitate with oxalate of ammonia, but, acidulated with hydrochloric acid, it is precipitated white by chloride of barium, and yellow by perchloride of platinum.

Dose.—15 to 50 or 60 grains or more, either dissolved in a considerable quantity of water, or as a combination with rhubarb, or with rhubarb and aloes in solution.

Therapeutics.—In large doses sulphate of potash may act as an irritant poison, and has caused death in several instances. In France it has been used to procure abortion. Medicinally, it is used as a mild saline purgative in dyspeptic and hepatic cases; it is also employed to repress the secretion of milk after parturition. It enters into *Pulvis Ipecacuanhæ Compositus*, of which it forms eight parts in ten by weight. It is introduced simply for its property of aiding the pulverisation of the ipecacuanha.

Potassii Nitras (KNO_3)—Nitrate of Potash—Saltpetre—Nitre.

The nitrate of potash of commerce, purified, if necessary, by crystallisation from solution in distilled water. The nitre or saltpetre of commerce is chiefly derived from certain districts in the East Indies. It is a natural production, and is met with either as an efflorescence upon the surface of the soil, or disseminated through its superficial stratum. It is separated by lixiviating the soil.

Characters.—In white crystalline masses or fragments of striated six-sided prisms, colourless, of a peculiar cool saline taste. Thrown on the fire, it deflagrates; warmed in a test-tube with sulphuric acid and copper wire, it evolves ruddy fumes. Its solution acidulated with hydrochloric acid gives a yellow precipitate with perchloride of platinum.

Dose.—10 to 30 grains. In the smaller doses of 5 or 10 grains, it may be given either in the form of powder or made into a draught with water and syrup; in the larger doses of several drachms to an ounce or more in twenty-four hours, it is given largely diluted in barley-water or other beverage, as a drink; or in the form of nitre-whey.

Therapeutics.—Nitrate of potash in large doses acts as an irritant poison, causing pain in the stomach and abdomen, with nausea, vomiting, and purging, followed by collapse; a feeling of cold referred to the spine, muscular tremors, convulsions, &c., have been observed. Medicinally, in the smaller doses, it acts as a refrigerant, diuretic, and diaphoretic, its effects being modified by the tendencies of the medicines with which it is combined, and the mode of its administration. As a refrigerant it is most active when dissolved in a little water immediately before it is taken. It has been recommended in continued fevers and in inflammatory affections, with the object of subduing the preternatural heat and reducing the force of the circulation, according to those who consider it to be a sedative of the heart and vascular system as well as a refrigerant. As a diuretic, it is sometimes given in dropsies. In spasmodic asthma the fumes of nitrate of potash (arising from burning paper previously saturated with a solution of the salt, and dried) sometimes give relief. In acute rheumatism, nitrate of potash is given in large doses, in some cases from an ounce to an ounce and a half in the twenty-four hours. As a gargle, it is occasionally used in incipient and relaxed sore throat; and externally, in combination with sal-ammoniac, it is used as a refrigerant lotion.

Potassii Acetas ($KC_2H_3O_2$)—Acetate of Potassium.

PREPARATION.—*Take of carbonate of potassium,* 20 *ounces; acetic acid,* 2 *pints, or a sufficiency. To the acetic acid, placed in a thin porcelain basin, add gradually the carbonate of potassium, filter, acidulate, if necessary, with a few additional drops of the acid, and, having evaporated to dryness, raise the heat cautiously, so as to liquefy the product. Allow the basin to cool, and when the salt has solidified, and while it is still warm, break it into fragments and put it into stoppered bottles.*

Characters.—White foliaceous satiny masses, very deliquescent, with a watery solution of which tartaric acid causes a crystalline precipitate, sulphuric acid, the disengagement of acetic acid, and a dilute solution of perchloride of iron strikes a deep-red colour.

Dose.—10 to 30 grains as a diuretic, sufficiently diluted; in larger doses it acts as a cathartic, but is seldom used for that purpose.

Therapeutics.—Acetate of potash in moderate doses acts as a diuretic, and being converted into the carbonate whilst in the system, it renders the urine alkaline as well as more copious. It is chiefly used as a diuretic in dropsies; also in the alkaline treatment of acute rheumatism, in certain skin diseases, and in the uric acid diathesis.

Potassii Chloras ($KClO_3$)—Chlorate of Potassium.

PREPARATION.—*Take of carbonate of potassium,* 20 *ounces; slaked lime,* 53 *ounces; distilled water, a sufficiency; black oxide of manganese,* 80 *ounces; hydrochloric acid,* 24 *pints. Mix the lime with the carbonate of potassium, and triturate them with a few ounces of the water, so as to make the mixture slightly moist. Place the oxide of manganese in a large retort or flask, and having poured upon it the hydrochloric acid, diluted with* 6 *pints of water, apply a gentle sand heat, and conduct the chlorine, as it comes over, first through a bottle containing* 6 *ounces of water, and then into a large carboy containing the mixture of carbonate of potassium and slaked lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with* 7 *pints of the water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallise. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling distilled water, and again allowing the solution to crystallise.*

Characters.—In colourless rhomboidal crystalline plates, with a cool saline taste, sparingly soluble in cold water. It explodes when triturated with sulphur. By heat it fuses, gives off oxygen gas, and leaves a white residue readily forming with water, a neutral solution, which is precipitated white by nitrate of silver, and yellow by perchloride of platinum.

Dose.—10 to 30 grains or more dissolved in water. For children, 2 to 5 grains in solution.

TROCHISCI POTASSII CHLORATIS—Chlorate of Potassium Lozenges.

PREPARATION.—*Take of chlorate of potassium, in powder,* 3600 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains* 5 *grains of chlorate of potash.*

Dose.—One to six lozenges.

Therapeutics.—Chlorate of potash acts locally as a stimulant. It has been supposed capable of supplying oxygen to the system, and also the deficiency of the saline constituents of the blood in cholera and other diseases; but it does not do so, as it is eliminated by the urine unchanged, and in all probability its medicinal action is purely local, hence it is principally used as a gargle. In cancrum oris, gangrenous stomatitis, aphthous and other ulcerations of the mouth, in diphtheria, cynanche, fetid breath, in scarlatina, &c. As a lotion it is applied to a variety of painful and indolent ulcers, and as an injection in affections of the genito-urinary organs. The lozenges are specially applicable for throat affections. Large doses given medicinally have proved poisonous to children. The symptoms are hæmaturia, with blood-cast and diminished secretion of urine. The skin becomes discoloured or jaundiced, and death occurs, with coma or convulsions. These symptoms are said to be due to the hæmoglobin of the blood being converted into methæmoglobin by the action of the chlorate.

Potassii Tartras Acida ($KHC_4H_4O_6$)—Acid Tartrate of Potassium—Potassæ Bitartras—Cream of Tartar.

An acid salt which is obtained from the crude tartar which is deposited during the fermentation of grape-juice, and from the lees of wine.

Acid tartrate of potassium, in an impure state, is obtained as a deposit from wine. It occurs in the juice of the fresh grape in a soluble form, but when the juice has undergone the vinous fermentation, its sugar being converted into alcohol, the salt is no longer soluble, and is deposited as "red argol" from red wines, and as "white argol" from white wines. In this state of crude tartar or argol it is met with in wine casks. It is purified by dissolving it in water with a small proportion of pipe-clay, leaving the pure tartrate to crystallise upon the surface of the liquor and the sides of the vessel.

Characters.—A gritty white powder, or fragments of cakes crystallised on one surface; of a pleasant acid taste, sparingly soluble in water, insoluble in spirit. Heated in a crucible, it evolves inflammable gas and the odour of burned sugar, and leaves a black residue. This effervesces with diluted hydrochloric acid, and forms a solution which, when filtered, gives a yellow precipitate with perchloride of platinum, and when neutralised by ammonia is rendered slightly turbid by oxalic acid.

Dose.—10 to 60 grains as a refrigerant and diuretic, and up to half an ounce as a cathartic, dissolved, or in the form of confection, or as a drink.

Therapeutics.—Acid tartrate of potassium in over-doses acts as an irritant poison; in the smaller doses it acts as a refrigerant and diuretic, and in the larger doses as a mild aperient, or as a hyragogue cathartic according to the quantity, acting more energetically when only partially dissolved or given in the form of confection. It is found in the urine in the form of carbonate, and renders it alkaline. It is given in fever and inflammatory diseases, in dropsical affections, in chronic affections of the liver; in combination with sulphur, as in the confection, it is given in hæmorrhoids, chronic dysentery, and diseases of the rectum; albuminuria, chronic cardiac diseases, &c. It is a constituent of sulphur confection and of compound powder of jalap.

Potassii Tartras ($K_2C_4H_4O_6H_2O$)—Tartrate of Potassium.

Preparation.—*Take of acid tartrate of potassium, 20 ounces, or a sufficiency; carbonate of potassium, 9 ounces, or a sufficiency; boiling distilled water, 2½ pints. Dissolve the carbonate of potassium in the water; add by degrees the acid tartrate of potassium, and if, after a few minutes' boiling, the liquid is not neutral to test-paper, make it so by the careful addition of more of the carbonate or of the acid tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallise. More crystals may be obtained by evaporating and cooling the mother-liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle.*

Characters.—In small colourless four or six-sided prisms. Heated with sulphuric acid it forms a black tarry fluid, evolving inflammable gas and the odour of burned sugar. Acetic acid added sparingly to its solution causes the separation of a white crystalline precipitate.

Dose.—As a diuretic, 20 to 60 grains; as a cathartic, in doses up to half an ounce, or more, dissolved in water or other vehicle, as infusion of senna, rhubarb, &c.

Therapeutics.—Tartrate of potassium in small doses acts as a diuretic, and being converted into the carbonate in the system, tends to render the urine alkaline. In larger doses it is employed as a mild saline cathartic.

Potassii Citras ($K_3C_6H_5O_7$)—Citrate of Potassium.

PREPARATION.—*Take of carbonate of potassium 8 ounces, or a sufficiency; citric acid, in crystals, 6 ounces, or a sufficiency; distilled water, 2 pints. Dissolve the citric acid in the water, and the carbonate of potassium gradually, and if the solution be not neutral, make it so by the cautious addition of the acid or the carbonate of potassium. Then filter, and evaporate to dryness, stirring constantly, after a pellicle has begun to form, till the salt granulates. Triturate in a dry warm mortar and preserve the powder in stoppered bottles.*

Characters.—A white powder, of saline feebly-acid taste, deliquescent, and very soluble in water. Heated with sulphuric acid it forms a brown fluid, gives off inflammable gas, and evolves the odour of acetic acid. Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate separates, readily soluble in acetic acid. Its solution, acidulated with hydrochloric acid, gives a yellow precipitate with perchloride of platinum.

Dose.—10 to 30 grains or more dissolved in water and sweetened.

Therapeutics.—Citrate of potassium acts as a diaphoretic, diuretic, and refrigerant: it does not affect the bowels so readily as the other neutral salts of potash.

It is converted into the carbonate in the system, and tends to render the urine alkaline. It is employed in febrile and inflammatory diseases, in cases of irritability of the stomach, in uric acid gravel, in gout and rheumatism, in scurvy, &c.

POTASSII FERROCYANIDUM—Ferrocyanide of Potassium—Yellow Prussiate of Potash, $K_4FeC_6N_6$, $3H_2O$.—Obtained by fusing animal substances, as cuttings of horns, hoofs, and skins, with carbonate of potassium and iron in an iron pot, lixiviating with water and crystallising.

Characters.—Large yellow crystals, soluble in water, the solution precipitating deep blue with persulphate of iron, brick-red with sulphate of copper and white with acetate of lead.

Use.—Employed in the preparation of hydrocyanic acid and cyanide of potassium.

POTASSII CYANIDUM—Cyanide of Potassium (KCN).—

Obtained by heating ferrocyanide of potassium at red heat until gas ceases to be evolved, allowing the sediment to subside in the still molten mass, and pouring off the clear fluid. It may be purified if necessary by solution in and crystallisation from spirit.

Characters.—White opaque deliquescent crystalline masses having the odour of hydrocyanic acid; soluble in water, it is intensely poisonous.

Use.—It is employed in the preparation of purified bismuth.

POTASSII BICHROMAS ($K_2Cr_2O_7$)—Bichromate of Potassium.—May be prepared by adding sulphuric acid to a solution of chromate of potassium, and setting aside the mixture until the crystals are deposited.

Characters.—In large red transparent four-sided tables; anhydrous; fuses below redness ; at a higher temperature is decomposed, yielding green oxide of chromium and yellow chromate of potash, which may be separated by dissolving the latter in water.

Therapeutics.—This salt is used in the preparation of valerianate of soda, but is not much employed in medicine. In over-doses it acts as a powerful irritant poison. In doses of a tenth to a fifth of a grain it is used as an alterative in secondary syphilis ; in larger doses of 1 or 2 grains it acts as an emetic, but is unsafe in consequence of its irritant properties. Externally, it is used as a caustic, either in the solid form or as a concentrated solution. Solutions of the bichromate act as antiseptics. Workmen employed in the manufacture of bichromate of potash are apt to suffer from painful ulcerations of the hands.

SODIUM ($Na = 23$)—*Sodium*—*Natrium*—the metallic element sodium as met with in commerce. It should be preserved in well stoppered bottles under mineral naphtha. It is a soft, malleable, wax-like, and somewhat silver-like metal, which burns with a yellow flame, floats on water, and readily tarnishes by oxidation when exposed to the air. It exists largely throughout nature in the form of common *salt* ($NaCl$), and is the metallic base of the soda compounds.

Soda Caustica ($NaHO$)—Sodæ Hydras.

PREPARATION.—*Take of solution of soda, 2 pints. Boil down the solution of soda rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. Pour the fluid on a clean silver or iron plate, or into moulds, and as soon as it has solidified break it in pieces, and preserve it in stoppered green-glass bottles.*

Characters.—Hard and greyish-white, very alkaline and corrosive. It imparts a yellow colour to flame, and its solution in water, acidulated by nitric acid, gives only scanty white precipitates with nitrate of silver and chloride of barium.

Antidotes, doses, actions, and uses same as caustic potash, than which it is less powerful and less deliquescent, but it is chiefly used for chemical purposes.

Liquor Sodæ—Solution of Soda.

PREPARATION.—*Take of carbonate of soda*, 28 *ounces; slaked lime*, 12 *ounces; distilled water*, 1 *gallon. Dissolve the carbonate of soda in the water; and, having heated the solution to the boiling point in a clean iron vessel, gradually mix with it the slaked lime, and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and when, by the subsidence of the insoluble matter, the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralising power.*

Antidotes, doses, actions, and uses similar to those of liquor potassæ, than which it is somewhat weaker. It is employed in the preparation of caustic soda, valerianate of soda, and sulphurated antimony.

Liquor Sodii Ethylatis—Solution of Ethylate of Sodium, NaC_2H_5O.—Take 22 grains of metallic sodium and 1 ounce of ethylic alcohol, dissolve the sodium in the alcohol contained in a flask, the latter being kept cool in a stream of cold water. The solution should be recently prepared.

Characters.—A colourless syrupy liquid becoming brown by keeping, sp. gr. 0·867. When heated it boils and gives off alcoholic vapours leaving a white salt, which, on being strongly heated, chars. If the white salt be mixed with water and heated it yields alcohol.

Therapeutics.—A useful caustic causing little pain. It should be applied with a pointed glass rod.

Sodii Carbonas (Na_2CO_3, $10H_2O$)—Carbonate of Sodium.

Obtained from the ashes of marine plants, or produced by chemical decomposition, with chloride of sodium.

Carbonate of sodium was formerly derived chiefly from barilla and kelp, the former being the ashes of *salsola soda*, and other maritime plants, the latter being the ashes of sea-weeds; but it is now commonly obtained from sea salt. The chloride of sodium is first converted into *salt-cake*, which consists of sulphate of soda; and this, being heated with crushed chalk and small coal, is converted into what is termed *ball soda* or *black-ash*, from which the carbonate is derived by lixiviation and subsequent purification.

Characters.—In transparent colourless laminar crystals of a rhombic shape, efflorescent, with a harsh alkaline taste and strong alkaline reaction. It imparts a yellow colour to flame, and dissolves with effervescence in diluted hydrochloric acid, forming a solution which does not precipitate with perchloride of platinum. By heat it undergoes aqueous fusion, and then dries up, losing 63 per cent. of its weight.

SODII CARBONAS EXSICCATA (Na_2CO_3)—DRIED CARBONATE OF SODIUM.—*Take of carbonate of sodium 8 ounces. Expose the carbonate of soda in a porcelain capsule to a rather strong sand heat until the liquid which first forms is converted into a dry cake; and, having rubbed this to powder, enclose it in a stoppered bottle.*

Antidotes, doses, actions, and uses same as carbonate of potash, except it is not so caustic, or tends to impoverish the blood if given for some time like the corresponding preparation of potash, neither is it so powerful a solvent of uric acid as potash. By some physicians, however, soda, and especially its carbonate, is believed to exert a specially beneficial alterative effect on mucous membranes, and on that account is prescribed in preference to potash in diseases involving those structures. Dried carbonate of soda is simply the previous carbonate, minus its water of crystallisation, so that 53 grains of the dried are equal to 143 grains of the common carbonate. It may be given in doses of 5 to 15 grains in pill or powder.

Sodii Bicarbonas ($NaHCO_3$)—Bicarbonate of Sodium.

PREPARATION.—*A salt obtained by saturating carbonate of sodium with carbonic acid, or by reaction of chloride of sodium and bicarbonate of ammonium.*

Characters.—In powder or small opaque irregular scales, white, of a saline not unpleasant taste. Imparts a yellow colour to flame. Dissolves with much effervescence in diluted hydrochloric acid, forming a solution in which perchloride of platinum causes no precipitate. A solution of the salt in cold water gives a white and not a coloured precipitate with solution of perchloride of mercury.

Dose.—10 grains to half a drachm, sufficiently diluted; or in the form of effervescing draughts in the proportion of 20 grains of the bicarbonate to 18 grains of tartaric acid, 17 grains of citric acid, or half an ounce of lemon juice. Externally, as a lotion or ointment.

Trochisci Sodii Bicarbonatis—Bicarbonate of Sodium Lozenges.

PREPARATION.—*Take of bicarbonate of sodium, in powder,* 3600 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce. Mix the powders, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains* 5 *grains of bicarbonate of soda.*

Dose.—One to six lozenges.

Liquor Sodæ Effervescens—Effervescing Solution of Soda—Soda Water.

PREPARATION.—*Take of bicarbonate of sodium,* 30 *grains; water,* 1 *pint. Dissolve the bicarbonate of sodium in the water, and filter the solution; then pass into it as much pure washed carbonic-acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of* 7 *atmospheres. Keep the solution in bottles securely closed to prevent the escape of the compressed gas.*

Characters and Tests.—Effervesces strongly when the containing vessel is opened, carbonic-acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste. 10 fluid ounces, after being boiled for five minutes, require for neutralisation 178 grain measures of the volumetric solution of oxalic acid.

It is given as a cooling antacid drink, and has all the actions of the bicarbonate of soda.

Therapeutics.—Bicarbonate of soda acts as an antacid and alterative, and is employed in dyspepsia, in acidity of the primæ viæ, in pyrosis, &c., for the same purposes as the corresponding salt of potash. As an antilithic, the potash salt is preferable, because urate of soda is much less soluble than urate of potash; and for the same reason the bicarbonate of soda is less eligible in gout and rheumatism. It has been recommended, dissolved in hot water, as a drink during the passage of gall stones; also to allay the vomiting of pregnancy. Externally, it is applied to a variety of skin diseases, either in the form of lotion, baths, or ointment, and is also given externally for the same purpose. In the form of Soda Water and Alkaline Mineral Waters it is largely used; but when long continued, in any form, it interferes with the processes of digestion and assimilation, and is contraindicated in all cases accompanied by deposition of phosphates in the urine.

Sodii Bromidum—Bromide of Sodium ($NaBr$).—Obtained in the same way as bromide of potassium, solution of soda being used in place of solution of potash, and crystallisation being conducted from warm solutions.

Characters.—A granular white powder consisting of small monoclinic crystals, somewhat deliquescent, inodorous, with a saline taste. Soluble in less than twice its weight of water, it gives the usual tests for sodium and bromine; mixed with mucilage of starch and a drop of solution of chlorine or bromine, it does not exhibit any blue colour (absence of iodide).

Dose.—10 to 30 grains.

Therapeutics.—Action similar to but less powerful than the bromide of potassium, and given in the same cases. It is also better borne by the stomach.

Sodii Iodidum—Iodide of Sodium (NaI).—Obtained like iodide of potassium, solution of soda being used in place of solution of potash.

Characters.—A dry white crystalline deliquescent powder, taste saline and somewhat bitter, readily soluble in water and spirit, it gives the usual tests for sodium and iodine. 10 grains require for complete precipitation about 660 grain measures of the volumetric solution of nitrate of silver.

Dose.—3 to 10 grains.

Therapeutics.—Action and uses same as the iodide of potassium, but causes less gastric irritations, and may be given in larger doses.

Sodii Chloridum ($NaCl$)—Chloride of Sodium—Common Salt—Table Salt—Sea Salt—Rock Salt.

Chloride of sodium is largely distributed throughout nature, both in the solid form of fossil and in beds of rock, and in solution in the sea and in brine springs. It is also met with in animal and vegetable tissues and fluids. The salt of commerce is obtained either by evaporating brine springs or sea-water, or by quarrying it from the rock-salt mines. In order to obtain the chloride in a pure state, the commerical varieties are frequently dissolved, washed, and recrystallised.

Characters and Tests.—In small white crystalline grains, or transparent cubic crystals, free from moisture, has a purely saline taste, imparts a yellow colour to flame, is soluble in water. The solution is not precipitated by perchloride of platinum, but gives with nitrate of silver a white precipitate, soluble in ammonia but insoluble in nitric acid.

Dose.—In doses of one or more table-spoonfuls, dissolved in water, it acts as an emetic and cathartic. In doses of half an ounce to an ounce, dissolved in a suitable fluid, it operates as a cathartic enema.

Therapeutics.—Chloride of sodium is essential as an adjunct to ordinary articles of diet; without it animal life cannot be sustained, and even its temporary withdrawal is followed by diseases. In small quantities it acts as an alterative and stimulant, rendering the food palatable, and improving the powers of digestion. In very large doses it acts as an irritant poison, causing inflammation of the alimentary mucous membrane; half a pound, taken, as a cure for worms, caused the death of a young lady, and a pound, taken in a pint of ale, killed a man in twenty-four hours; but much smaller quantities, as 1 or 2 ounces, have caused alarming symptoms. Medicinally, salt is given as an anthelmintic, and is administered both by the stomach and by the rectum; it has been recommended in large and frequently-repeated doses in cholera. Externally, salt acts as a rubefacient and stimulant; in the form of salt-water baths it is employed as a discutient, tonic, and deobstruent, sometimes combined with the internal use of sea-water. A saturated solution of salt is used as a collyrium in chronic granular ophthalmia. Chloride of sodium is also used as an antidote in poisoning by nitrate of silver, and to cause the removal of leeches from the skin, or their death, when they have accidentally entered any of the orifices of the body.

Borax ($Na_2B_4O_7$, $10H_2O$)—Sodæ Biboras—Biborate of Soda.—Borax was formerly chiefly imported from India under the names of *Tincal* and *Crude Borax;* in this form it occurs as a natural production, by spontaneous evaporation, on the shores of certain lakes in Thibet; from this the refined borax was obtained either by calcination or by washing in an alkaline ley. It is now manufactured by saturating boric acid, obtained from the lagoons of Tuscany, with carbonate of sodium; the mixture is thrown in successive quantities upon the floor of a reverberatory furnace, and impurities are subsequently separated by lixiviation.

Characters.—In transparent colourless crystals, sometimes slightly effloresced, with a weak alkaline reaction; insoluble in rectified spirit, soluble in water. A hot saturated solution, when acidulated with any of the mineral acids, lets fall, as it cools, a scaly crystalline deposit (boracic acid), the solution of which in spirit burns with a green flame.

MEL BORACIS—*Borax Honey* (not official).—*Take of borax, in fine powder,* 60 *grains; glycerine,* 30 *grains; clarified honey,* 1 *ounce. Mix.*

Dose.—15 or 20 to 30 grains, dissolved in water. As a lotion or gargle, 3 or 4 drachms in 8 ounces of water. The honey may be allowed to dissolve in the mouth, or be dissolved in water to make a wash or gargle.

Glycerinum Boracis—Glycerine of Borax.

Preparation.—*Take of Borax, in powder, 1 ounce; glycerine, 4 fluid ounces; distilled water, 2 fluid ounces. Rub them together in a mortar until the borax is dissolved, or heat gently until solution is effected.*

This preparation may be used instead of mel boracis, and is, besides, very suitable for making a gargle, in the strength of about 1 ounce to 8 ounces of water.

Therapeutics.—Borax is said to act as an antacid, antilithic, diuretic, refrigerant, and emmenagogue, and topically as an astringent. It is chiefly used as an application to the mouth in cases of aphthous ulcerations, fissures of the tongue, and mercurial salivation. Externally, it is applied as an application to sore nipples, and to certain skin diseases, such as pityriasis versicolor, impetigo, psoriasis, eczema, acne, prurigo, &c.; also, dissolved in distilled vinegar, as an application to ringworm. As an injection, it is used in leucorrhœa, and in gonorrhœa, and into the bladder as a solvent for calculi. It is not much given internally, but has been recommended as an emmenagogue, and to stimulate the uterus in cases of tedious labour and retention of the placenta. It is more than doubtful, however, whether it possesses any real oxytocic virtues. It has been criminally used to cause abortion, and has occasionally produced that effect when administered for other purposes.

Sodii Sulphis—Sulphite of Sodium (Na_2SO_3, $7H_2O$).—Obtained by the action of sulphurous acid on carbonate of sodium or on caustic soda.

Characters.—Colourless transparent monoclinic prisms, efflorescent in dry air, inodorous, taste cool, saline and sulphurous, soluble in water and spirit, treated with hydrochloric acid it evolves a sulphurous vapour.

Dose.—5 to 20 grains.

Therapeutics.—The sulphites of soda are given internally in vomiting accompanied by the presence of sarcinæ ventriculi, SO_2 being evolved when it comes in contact with the acids of the stomach. In large doses, as 1 drachm to half an ounce, the sulphites act as purgatives. Externally, it is employed as a lotion in parasitic skin diseases.

Hyposulphite of Sodium ($Na_2S_2H_2O_4$, $4H_2O$)—Sodæ Hyposulphis.—This salt may be prepared by digesting a solution of the sulphite with sulphur ($Na_2SO_3+S+H_2O=Na_2S_2H_2O_4$); or by passing sulphurous-acid gas through a solution of sulphide of sodium ($2Na_2S+3SO_2+2H_2O=2Na_2S_2H_2O_4+S$); or by other processes. It occurs in prismatic crystals, which have a bitter, saline, disagreeable taste; are inodorous, readily soluble in water, but not in alcohol; are decomposed by heat; and, on the addition of acids, are resolved into SO_2, which is evolved, and sulphur, which is deposited. When pure, 24·8 grains decolorise 1000 grain measures of the volumetric solution of iodine.

Therapeutics.—The experiments of Professor Polli on dead and living organisms led him to the conclusion that sulphurous acid, sulphites and hyposulphites of lime, soda, &c., are possessed of valuable antiseptic properties, which are capable of being utilised in medicine to prevent or modify the progress of diseases believed to be due to the action of morbid ferments in the blood. For this reason he recommends the internal use of sulphites and hyposulphites in pyæmia, typhoid fever, glanders, &c. Now, though we may doubt the soundness of the pathological doctrine on which Polli proceeds, yet we have reason to believe that the sulphites exert, in many cases, beneficial effects in disease by their antisceptic action upon putrescent secretions, as in the case of alkaline urine from diseased bladder, and in diarrhœa with very offensive stools, &c. In small doses (10 or 20 grains to a drachm), hyposulphite of soda acts as an alterative, sudorific, and resolvent; in large doses (one or more drachms) it acts, like sulphate of soda, as a cathartic. In alterative doses it is given in *Sarcinæ ventriculi*, SO_2 being evolved when the salt comes into contact with the acids of the stomach. It is also used in a variety of diseases as a substitute for the natural sulphur waters; in cutaneous, scrofulous, hepatic, syphilitic, gouty, and rheumatic affections. Externally, in the form of lotion, or as a bath (℥½–i to each gallon of water), in parasitic skin diseases. Sometimes a little dilute sulphuric acid is added to the lotions and baths in order to set the sulphurous acid at liberty; care must then be taken to protect the air-passages from the suffocating effects of the SO_2.

Sodii Sulphas (Na_2SO_4, $10H_2O$)—Sulphate of Soda—Glauber's Salt.

PREPARATION.—*May be obtained from the residue left in the manufacture of hydrochloric acid, from chloride of sodium, by neutralising it with carbonate of soda, and crystallising from solution in water.*

Characters.—In transparent oblique prisms; has a salt and bitter taste; effloresces on exposure to the air; soluble in water, insoluble in spirit.

Dose.—One quarter to one ounce.

Therapeutics.—Sulphate of soda is a mild but efficient cooling laxative and diuretic in medicinal doses. It also increases slightly the biliary secretion, and prevents cholesterin concretions or gall stones and renal calculi. In very large doses, and sparingly diluted, it has been known to act as an irritant poison. It is used as a purgative, either alone or combined with other purgatives, and is especially suited for febrile cases, owing to its refrigerant properties; but the sulphate of magnesia is generally preferred to it, on account of its taste being less bitter. Like the magnesium sulphate, it may be used as an antidote for poisoning with lead and baryta.

Sodii Phosphas (Na_2HPO_4, $12H_2O$)—Phosphate of Sodium.—This salt may be obtained by adding a solution of carbonate of sodium to a solution of acid phosphate of calcium, prepared from a mixture of bone ash and sulphuric acid.

Characters.—In transparent, colourless rhombic prisms, terminated by four converging planes, efflorescent, tasting like common salt. It imparts a yellow colour to flame. Its solution has a faintly-alkaline reaction, it gives a yellow precipitate with nitrate of silver, the resulting fluid acquiring an acid reaction.

Dose.—As a saline cathartic, half an ounce to an ounce or more, in solution, or as a substitute for common salt, in broth or soup. In smaller doses it is alterative and antilithic.

Therapeutics.—Phosphate of soda acts as a mild saline cathartic, producing thin, watery stools, and, being less offensive to the palate than the sulphates of soda or magnesia, it is suitable for children or delicate adults. When given in mutton, veal, or chicken broth, its taste is scarcely distinguishable from that of common salt. It is employed in cases of simple constipation; in the saline treatment of cholera; as a solvent of uric acid deposits; as a gentle aperient in diabetes; as a local application in gout, &c.

Sodæ Hypophosphis—Hypophosphite of Sodium ($NaPH_2O_2$).—Obtained by adding carbonate of sodium to solution of hypophosphite of calcium as long as a precipitate of carbonate of calcium is formed, then filtering the solution and evaporating it to dryness by the heat of a steam bath, keeping it constantly stirred when the salt begins to solidify.

Characters.—A white granular salt having a bitter nauseous taste, it is deliquescent, very soluble in water and spirit, but insoluble in ether. At a red heat it ignites, emitting spontaneously inflammable phosphuretted hydrogen.

Therapeutics.—Identical to hypophosphite of lime.

Dose.—5 to 10 grains.

Sodii Acetas ($NaC_2H_3O_23H_2O$)—Acetate of Sodium (Appendix).

Acetate of soda may be prepared by the action of carbonate of soda upon acetic acid, or by saturating impure pyroligneous acid with chalk or slaked lime, and afterwards decomposing the acetate of lime by means of sulphate of soda.

Characters.—In transparent, colourless crystals, soluble in water, forming a solution neutral to test-paper.

Uses.—Acetate of soda is used as a test, and is employed in the preparation of glacial acetic acid and of phosphate of iron. Medicinally, it is scarcely ever used. Its properties and doses are similar to those of acetate of potash.

Sodii Citrotartras Effervescens—Effervescing Citro-tartrate of Sodium.

PREPARATION.—*Take of bicarbonate of sodium, in powder,* 17 *ounces; tartaric acid, in powder,* 8 *ounces; citric acid, in powder,* 6 *ounces; refined sugar,* 5 *ounces. Mix the powders thoroughly, place them in a dish or pan of suitable form, heated to between* 200° *and* 220° F. (93°·3 *and* 104°·4 C.), *and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of a suitable sieve, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles.*

Dose.—60 grains to half an ounce.

Therapeutics.—The granular form is especially convenient, as it allows the water to act gradually upon the salt, and thus moderates the rapidity of effervescence. The preparation is apt to absorb water from the air, whereby its constituents combine chemically, forming the citrate and tartrate of soda; hence the necessity of keeping it in stoppered bottles.

It is an exceedingly agreeable antacid effervescent refrigerant drink in teaspoonful doses. A teaspoonful may be put into a tumbler, about two-thirds full of water, mixed with a little sugar. It should be taken while the effervescence is going on. In doses of from 2 drachms to half an ounce it is a mild saline purgative, superior to the popular medicine known by the name of the granulated effervescing citrate of magnesia, which usually contains a considerable amount of sulphate of magnesia.

Soda Tartarata ($NaKC_4H_4O_64H_2O$)—Sodæ et Potassæ Tartras—

Tartrate of Sodium and Potassium—Sel de Seignette—Rochelle Salt.

PREPARATION.—*Take of acid tartrate of potassium, in powder*, 16 *ounces, or a sufficiency; carbonate of sodium*, 12 *ounces, or a sufficiency; boiling distilled water*, 4 *pints. Dissolve the carbonate of soda in the water, add gradually the acid tartrate of potash, and if, after being boiled for a few minutes, the liquid has an acid or alkaline reaction, add a little carbonate of soda or acid tartrate of potash, till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallise. More crystals may be obtained by again evaporating as before.*

Characters.—In colourless, transparent prisms or halves of prisms of the right rhombic order, generally eight-sided; tasting like common salt. Heated with sulphuric acid, it blackens, evolving inflammable gases and the odour of burnt sugar. It imparts a yellow colour to flame. A strong solution gives a crystalline precipitate with a small quantity of acetic acid.

Doses.—From 30 grains to half an ounce, well-diluted. It is the active ingredient of Seidlitz powders, each of which contains 120 grains of the salt, with 40 grains of bicarbonate of soda in the blue paper, and 30 grains of tartaric acid in the white.

Therapeutics.—Tartrate of soda and potash in small doses acts as a diuretic, and renders the urine alkaline. In the larger doses it acts as a mild saline cathartic. It is cooling, and therefore a suitable aperient in febrile and inflammatory states; and as an antilithic it is useful in uric acid deposits; it is given also in gout and rheumatism.

Sodii Nitras—Nitrate of Sodium.—A native salt purified by crystallisation from water.

Characters.—In colourless obtuse rhombohedral crystals, having a cooling saline taste. Thrown on the fire, it deflagrates.

Therapeutics.—It is only used to prepare the arseniate of sodium.

Sodii Valerianas ($NaC_5H_9O_2$)—Valerianate of Sodium.

PREPARATION.—*Take of amylic alcohol (fousel oil)*, 4 *fluid ounces; bichromate of potassium*, 9 *ounces; sulphuric acid*, $6\frac{1}{2}$ *fluid ounces; solution of soda, a sufficiency; distilled water*, $\frac{1}{2}$ *gallon. Dilute the sulphuric acid with* 10 *fluid ounces of the water, and dissolve the bichromate of potassium in the remainder of the water with the aid of heat. When both liquids are cold, mix them with the fousel oil in a matrass, with occasional brisk agitation, until the temperature of the mixture has fallen to about* 90°. *Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled* *liquid accurately with the solution of soda, remove any oil which floats on the surface, evaporate till the watery vapour ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle.*

Characters.—In dry white masses, without alkaline reaction, entirely soluble in rectified spirit, and giving out a powerful odour of valerian on the addition of diluted sulphuric acid.

Therapeutics.—Valerianate of soda is employed in the preparation of the valerianates.

Dose.—1 to 5 grains.

LITHIUM (L=7) obtains its name from λίθος, *a stone*, and from the fact that it was at first believed to belong only to the mineral kingdom; but though sparingly, it is widely distributed. It is a white or reddish-white metal, of a hardness between that of potassium and lead. It is the lightest of known solid substances (sp. gr. 0·5936), burns in air with a brilliant bright light, forming its only oxide—lithia (L_2O), and is obtained chiefly from the minerals *lepidolite*, *triphane*, and *petalite;* it is met with also in fire-clay, in many micas and felspars, in several mineral springs, &c.

Lithii Carbonas (L_2CO_3)—Carbonate of Lithia.—May be prepared by adding a strong solution of carbonate of ammonia to a concentrated solution of the sulphate of lithia, and heating the mixture, from which the carbonate separates as a white deposit, which may be crystallised by cooling from a solution in water.

Characters.—In white powder or in minute crystalline grains alkaline in reaction, soluble in 150 parts of cold water, insoluble in alcohol. It dissolves with effervescence in hydrochloric acid; and the solution, evaporated to dryness, leaves a residue of chloride of lithium, which communicates a red colour to the flame of a spirit-lamp, and, redissolved in water, yields a precipitate with phosphate of sodium.

Liquor Lithiæ Effervescens—Effervescing Solution of Lithia —Aqua Lithiæ Effervescens—Lithia Water.

Preparation.—*Take of carbonate of lithia,* 10 *grains; water,* 1 *pint. Mix in a suitable apparatus, and pass into it as much pure washed carbonic-acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of* 4 *atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.*

Dose.—5 to 10 fluid ounces.

Therapeutics.—This preparation has been made official chiefly to ensure a standard strength, and is simply a pleasant mode of administering the carbonate of lithia.

Carbonate of lithium acts as an alkaline, antilithic, lithontripic, and diuretic. In consequence of its low combining proportion, it neutralises more acid than an equal quantity of the corresponding salts of potash and soda; and it has, therefore, been recommended as a superior remedy in the treatment of the uric acid and gouty diathesis; and not only because of its stronger affinity for uric acid, but also because urate of lithia is exceedingly soluble, it is also diuretic, and so favours the elimination of urate of lithia.

Dose.—2 to 6 grains well diluted. It may also be employed externally (Garrod), as a lotion, 4 grains to the ounce, to parts affected with gouty inflammation, to joints stiffened by chronic gout, to gouty ulcers, and chalk stones covered with unbroken skin.

Lithii Citras ($L_3C_6H_5O_7$, $4H_2O$)—Citrate of Lithium.

PREPARATION.—*Take of carbonate of lithium*, 50 *grains; citric acid in crystals*, 90 *grains; warm distilled water*, 1 *fluid ounce. Dissolve the citric acid in the water, and add the carbonate of lithium in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam or sand bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber at the temperature of about* 240°, *then rapidly pulverised, and enclosed in a stoppered bottle.*

Characters.—A white amorphous powder, deliquescent, and soluble in water, without leaving any residue. Heated to redness it blackens, evolving inflammable gases; and the residue, neutralised by hydrochloric acid, yields with rectified spirit a solution which burns with a crimson flame.

Actions and uses same as the carbonate, than which it is much more soluble, and unlike which, it is deliquescent. It is converted into the carbonate in the system. It may be given in somewhat larger doses than the carbonate.

AMMONIUM ($2NH_4 = 18$).—This is the hypothetical compound base of the ammonia salts. Their chief source is gas liquor obtained in the distillation of coal. This is neutralised by hydrochloric acid, and yields the chloride of ammonium, NH_4Cl, and from the salt the preparations used in pharmacy are directly or indirectly made.

Liquor Ammoniæ Fortior—Aqua Ammoniæ Fortior—Strong Solution of Ammonia.—Ammoniacal gas, NH_3, dissolved in water, and constituting 32·5 per cent. of the solution.

PREPARATION.—*Take of chloride of ammonium, in coarse powder,* *3 pounds; slaked lime, 4 pounds; distilled water, 32 fluid ounces. Mix the lime with the chloride of ammonium, and introduce the mixture into an iron bottle placed in a metal pot surrounded by sand. Connect the iron tube, which screws air-tight into the bottle in the usual manner by corks, glass tubes, and caoutchouc collars, with a Woulf's bottle capable of holding a pint; connect this with a second Woulf's bottle of the same size, the second bottle with a matrass of the capacity of 3 pints, in which 22 ounces of the distilled water are placed, and the matrass, by means of a tube bent twice at right angles, with an ordinary bottle containing the remaining 10 ounces of distilled water. Bottles one and two are empty, and the latter and the matrass which contains the 21 ounces of distilled water are furnished each with a siphon safety-tube charged with a very short column of mercury. The heat of a fire, which should be very gradually raised, is now to be applied to the metal pot, and continued until bubbles of condensible gas cease to escape from the extremity of the glass tube which dips into the water of the matrass. The process being terminated, the matrass will contain about 43 fluid ounces of strong solution of ammonia.*

Characters.—A colourless liquid, with a characteristic and very pungent odour, and strong alkaline reaction.

LIQUOR AMMONIÆ—SOLUTION OF AMMONIA—Ammoniacal Gas, NH_3, dissolved in water.—*Take of strong solution of ammonia, 1 pint; distilled water, 2 pints. Mix and preserve in a stoppered bottle.*

Dose.—10 to 30 minims, well diluted with water.

LINIMENTUM AMMONIÆ—LINIMENT OF AMMONIA.—*Take of solution of ammonia, 1 fluid ounce; olive oil, 3 fluid ounces. Mix together with agitation.*

Therapeutics.—Gaseous ammonia, in the undiluted state, is irrespirable, causing spasm of the glottis and asphyxia; when somewhat diluted with atmospheric air, it acts as a violent irritant of the respiratory mucous membrane, and is capable of causing death by producing inflammation of the air-passages. Strong solution of ammonia also acts as a violent irritant and corrosive poison, causing intense burning pain in the mouth, pharynx, œsophagus, and stomach, great difficulty in swallowing, sense of suffocation, and pain in the respiratory organs. Sometimes there is vomiting and purging, &c. Poisoning by ammonia and its carbonate resembles that by the caustic alkalies, potash and soda and their carbonates; but in consequence of its volatility the air-passages are always seriously implicated in the ammonia cases. Great care should be taken when ammonia is em-

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ployed as a restorative, in cases where the patient s insensible, that the vapour or solution be sufficiently diluted; otherwise dangerous results may ensue. Treatment, give dilute acids and treat the symptoms. Externally, ammonia acts also as a powerful local irritant, producing rubefaction, vesication, or cauterisation, according to the strength and length of time of the application. Medicinally, ammonia is employed as a diffusible stimulant and restorative, antacid, antispasmodic, diaphoretic, sudorific, expectorant, antidote, counter-irritant, vesicant, &c. It has been recommended in the later stages of febrile and inflammatory diseases, and in other cases where there is great nervous prostration, and to promote the eruption in febrile exanthemata; in the later stages of pneumonia, and in chronic bronchitis; in atonic dyspepsia, with acidity of the primæ viæ, and flatulence; in syncope; in hysteria; to dissipate the effects of alcohol; in delirium tremens; as an antidote to sedative poisons, such as hydrocyanic acid, digitalis, &c. Externally, it is employed as a counter-irritant in chronic pulmonary affections, in tic douloureux and other neuralgic affections; it is used also as an adjunct to stimulating embrocations, to be applied to sprains, rheumatic pains, stiff joints, sore throat, ringworm, alopœcia, &c. As an antidote to the bites of serpents and venomous insects it is both locally applied and given internally; but as an antidote for snake-bites it is useless (Sir J. Fayrer). As a vesicant, it may be employed when prompt vesication is demanded, and in cases, especially affections of the urinary organs, in which cantharides is contra-indicated.

SPIRITUS AMMONIÆ FŒTIDUS—FETID SPIRIT OF AMMONIA.—*Take of assafœtida,* 1½ *ounce; strong solution of ammonia,* 2 *fluid ounces; rectified spirit, a sufficiency. Break the assafœtida into small pieces and macerate it, in a closed vessel, in* 15 *fluid ounces of the spirit for twenty-four hours, then distil off the spirit, mix the product with the solution of ammonia, and add sufficient rectified spirit to make* 1 *pint.*

Dose.—½ to 1 fluid drachm.

Therapeutics.—This preparation is intended to combine the stimulant and antispasmodic effects of the ammonia and assafœtida. It is suitable for cases of hysteria, but its disagreeable taste and odour form serious objections to its use.

Ammonii Carbonas—Carbonate of Ammonium—Ammoniæ Sesquicarbonas, $N_3H_{11}C_2O_5$—Sal Volatile.—A volatile, pungent, ammoniacal salt, produced by submitting a mixture of sulphate or chloride of ammonium and carbonate of calcium to sublimation and resublimation. It is considered to be a compound of acid carbonate of ammonium (NH_4HCO_3) with carbonate of ammonium ($NH_4NH_2CO_2$), and the compound molecule is usually regarded as containing one molecule of each of these salts.

Characters.—In translucent crystalline masses, with a strong ammoniacal odour and alkaline reaction; soluble in cold water, more sparingly in spirit, and readily dissolved by acids with effervescence. When exposed to the air it loses, in a great measure, its pungent odour; is no longer translucent, but covered with a white powder, being converted into bicarbonate.

Dose.—2 to 10 grains in solution.

SPIRITUS AMMONIÆ AROMATICUS—AROMATIC SPIRIT OF AMMONIA—SPIRIT OF SAL VOLATILE.—*Take of carbonate of ammonia,* 4 *ounces; strong solution of ammonia,* 8 *fluid ounces; volatile oil of nutmeg,* 4 *fluid drachms; oil of lemon,* 6 *fluid drachms; rectified spirit,* 6 *pints; water,* 3 *pints. Mix, and distil* 7 *pints.*

Dose.—20 to 60 minims.

Therapeutics.—Carbonate of ammonia acts as a stimulant, antacid, diaphoretic, expectorant, antispasmodic, &c.; in larger doses, as an emetic, and in over-doses as an irritant poison. Medicinally, the carbonate is employed in the same cases as were mentioned under liquor ammoniæ. It has been recommended in diabetes, scarlatina, rubeola, erysipelas, &c. As an emetic, it is sometimes used in narcotic poisoning, in chronic bronchitis, suffocative catarrh, and other cases in which there is great debility. Aromatic spirit of ammonia is used as an agreeable substitute for liquor ammoniæ, which it resembles, in proportion to its strength, in medicinal properties.

Ammonii Chloridum (NH_4Cl)—Chloride of Ammonium—Hydrochlorate of Ammonia—Sal Ammoniac.—May be formed by neutralising hydrochloric acid with ammonia or carbonate of ammonium, and evaporating to dryness. It is usually prepared by sublimation.

Characters.—In colourless, inodorous, translucent, fibrous masses tough, and difficult to powder; soluble in water and in rectified spirit. Its aqueous solution when heated with caustic potash evolves ammonia, and when treated with nitrate of silver forms a copious curdy precipitate.

Therapeutics.—Chloride of ammonium in over-doses acts as an irritant poison; in small medicinal doses it is stated to be alterative, sedative, diaphoretic, diuretic, emmenagogue, resolvent, liquefacient, discutient, refrigerant, &c., and in larger doses purgative. Formerly it was but little used internally in this country, though highly valued on the Continent; but more recently it has met with greater acceptance. It has been recommended as a substitute for mercury and iodide of potassium for the removal of chronic indurations and enlargements, and in chronic inflammatory diseases, especially in acute congestion of the liver (Dr Stewart); it has been given in neuralgic and rheumatic affections, in hæmorrhages from the lungs, stomach, and uterus; in passive dropsies, especially of hepatic origin; in typhus, typhoid, and intermittent fevers; in chronic affections of the lungs, &c. In facial neuralgia, orginating in or aggravated by toothache, it frequently gives great relief. Externally, as a discutient lotion applied to glandular enlargements, incipient abscesses, ecchymoses, &c.; and as a refrigerant lotion in affections of the brain, sprains, &c.

Dose.—5 to 30 grains.

Liquor Ammonii Acetatis Fortior—Strong Solution of Acetate of Ammonium, $NH_4C_2H_3O_2$.

Preparation.—*Take of carbonate of ammonium* 17½ *ounces; acetic acid,* 50 *fluid ounces; distilled water, a sufficiency; crush the carbonate of ammonium, add acetic acid until a neutral liquid results, then add sufficient water to make up to* 3 *pints.*

Characters.—Colourless, odourless, taste strongly saline, neutral in reaction; treated with potash, it evolves ammonia and with sulphuric acid acetic vapour. Sp. gr. 1·073.

Liquor Ammonii Acetatis—Solution of Acetate of Ammonium—Spirit of Mindererus.—Strong solution of acetate of ammonium, 4 fluid ounces; distilled water, sufficient to produce 1 pint. Sp. gr. 1·022.

Dose.—2 to 6 fluid drachms; of the strong solution *dose* 25 to 75 minims.

Therapeutics.—Solution of acetate of ammonia acts as a diaphoretic, diuretic, and refrigerant. Internally it is administered at the outset of febrile and inflammatory cases, especially in the exanthemata; in influenza; in catarrh; in dysmenorrhœa; in inflammatory dropsy, &c.

Liquor Ammonii Citratis Fortior—Strong Solution of Citrate of Ammonium $(NH_4)_3C_6H_5O_7$.

Citric acid, 12 *ounces; strong solution of ammonia,* 11 *fluid ounces, or a sufficiency; distilled water, a sufficiency; neutralise the acid with the ammonia, and add sufficient water to make* 1 *pint.* Sp. gr. 1·209.

Dose.—½ to 1½ fluid drachms.

Liquor Ammonii Citratis—Solution of Citrate of Ammonium.—

Strong solution of citrate of ammonium, 5 fluid ounces ; distilled water sufficient to make 1 pint. Sp. gr. 1·062.

Dose.—2 to 6 fluid drachms.

Therapeutics.—The solution of citrate of ammonia acts as a febrifuge, refrigerant, diaphoretic, and diuretic, and is employed in the same cases as solution of the acetate, than which it is considered to be more agreeable.

Ammonii Benzoas ($NH_4C_7H_5O_2$)—Benzoate of Ammonium.

PREPARATION.—*Take of solution of ammonia, 3 fluid ounces, or a sufficiency; benzoic acid, 2 ounces; distilled water, 4 fluid ounces. Dissolve the benzoic acid in 3 fluid ounces of solution of ammonia previously mixed with the water; evaporate at a gentle heat, keeping ammonia in slight excess, and set aside, that crystals may form.*

Characters.—In colourless laminar crystals, soluble in water and alcohol. It gives a bulky yellowish precipitate with persalts of iron. Its aqueous solution, when heated with caustic potash, evolves ammonia, and if it be not too dilute, when acidulated with hydrochloric acid, it gives a deposit of benzoic acid.

Dose.—10 to 30 grains, in solution.

Therapeutics.—Benzoate of ammonia possesses medicinal properties similar to those of benzoic acid, than which it is more soluble, and therefore preferable. It renders the urine acid and irritating, its benzoic acid being converted into hippuric acid, in which state it is eliminated by the kidneys. It acts as a stimulating diuretic, and as a stimulant both to the urinary and pulmonary mucous membranes. It has been recommended in chronic inflammation with mucous discharge from the bladder, and in all cases in which there is a tendency to phosphatic deposits; in catarrhal affections of the pulmonary mucous membranes; in jaundice; and also in cases of uric acid deposits, and in gout, on the supposition that it possesses the property of converting uric acid into hippuric acid, but probably it has no such influence.

Ammonii Nitras (NH_4NO_3)—Nitrate of Ammonium.

Produced by neutralising diluted nitric acid with solution of ammonia or carbonate of ammonium evaporating the solution till crystals are obtained, and keeping these fused, at a temperature not exceeding 320° F. (160° C.), until the vapour of water is no longer emitted.

Characters.—A white deliquescent salt, in confused crystalline masses, having a bitter acrid taste. Soluble in less than its own weight of water, and sparingly soluble in rectified spirit.

This salt is used almost exclusively for the preparation of nitrous oxide gas.

Ammonii Phosphas $(NH_4)_2HPO_4$)—Phosphate of Ammonium.

PREPARATION.—*Take of diluted phosphoric acid, 20 fluid ounces; strong solution of ammonia, a sufficiency. Add the ammonia to the phosphoric acid until the solution is slightly alkaline; then evaporate the liquid, adding more ammonia from time to time, so as to keep it in slight excess, and when crystals are formed on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile, and preserve them in a stoppered bottle.*

Characters.—In transparent colourless prisms; soluble in water, insoluble in rectified spirit. When heated with caustic potash, ammonia is evolved; the aqueous solution gives a yellow precipitate with nitrate of silver.

Dose.—10 to 40 grains, in solution.

Therapeutics.—Phosphate of ammonium has been chiefly recommended in the uric acid and gouty diatheses; it is supposed to dissolve the urate of soda by forming the urate of ammonia and phosphate of soda, both of which are soluble. It has also been employed in rheumatism, and as a diaphoretic and discutient.

GROUP II. METALS OF THE ALKALINE EARTHS—BARIUM, CALCIUM, MAGNESIUM.

BARIUM (Ba=137) is a greyish-white metal, having somewhat the appearance of silver; it melts below a red heat, burns with a red light, and, when exposed, soon oxidises. It is the metallic base of

BARYTA (BaO)—Barytes—Baryta—Oxide of Barium.—Takes its name from its great weight (Βαρύς, heavy). It has an alkaline taste and reaction, and is very poisonous.

BARII CHLORIDUM ($BaCl_2$)—Chloride of Barium is placed in the Appendix of the Pharmacopœia. It may be prepared by the action of hydrochloric acid upon carbonate of baryta ($BaCO_3+2HCl=BaCl_2+H_2O+CO_2$), or by first heating sulphate of baryta with charcoal, whereby it is converted into sulphuret or sulphide of barium, and acting upon this with hydrochloric acid ($BaS+2HCl=H_2S+BaCl_2$). It forms colourless, transparent, tabular, four-sided crystals or rhombic plates, bevelled at the edges; these are permanent in air, or efflorescent, if the air be very dry; are inodorous, and have a disagreeable bitter acrid taste. With sulphuric acid and soluble sulphates, chloride of barium throws down a dense white precipitate, insoluble in nitric acid. Medicinally, chloride of barium has been employed as an alterative, tonic, and deobstruent in scrofulous affections, &c.; but it is highly poisonous, and is rarely used. *Dose.*—Half a grain to a grain or 2 grains, only in solution. *Antidote.*—A soluble sulphate (especially Epsom salts), to form the insoluble sulphate of baryta.

CALCIUM ($Ca = 40$) is a yellowish malleable metal; sp. gr. 1·57. It is fusible at a red heat, and burns when heated in air. It slowly oxidises when exposed to the atmosphere, and is the metallic base of

Calx (CaO)—Oxide of Calcium—Lime—Caustic Lime—Quicklime.—An alkaline earth (CaO) with some impurities, obtained by calcining chalk or limestone, so as to expel carbonic acid.

Characters.—In compact masses of a whitish colour, which readily absorb water, and which, when rather less than their weight of water is added, crack and fall into powder with the development of much heat. The powder obtained by this process of slaking, when agitated with distilled water, gives, after filtration, a clear solution, which has an alkaline reaction, and yields a white precipitate with oxalate of ammonia.

CALCII HYDRAS $Ca(HO)_2$—HYDRATE OF LIME—SLAKED LIME.—*Take of lime, 2 pounds; distilled water, 1 pint. Place the lime in a metal pot, pour the water upon it, and, when vapour ceases to be disengaged, cover the pot with its lid, and set it aside to cool. When the temperature has fallen to that of the atmosphere, put the slaked lime on an iron-wire sieve, and, by gentle agitation, cause the fine powder to pass through the sieve, rejecting what is left. Put the powder into a well-stoppered bottle, and keep it excluded as much as possible from the air. Slaked lime should be recently prepared.*

LIQUOR CALCIS—SOLUTION OF LIME—LIME WATER.—*Take of slaked lime, 2 ounces; distilled water, a sufficiency. Put the lime into a stoppered bottle containing the water, and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green-glass bottle furnished with a well-ground stopper.*

LIQUOR CALCIS SACCHARATUS—SACCHARATED SOLUTION OF LIME.—*Take of slaked lime, 1 ounce; refined sugar, in powder, 2 ounces; distilled water, 1 pint. Mix the lime and the sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water,* *and, having closed this with a cork, shake it occasionally for a few hours. Finally, separate the clear solution with a siphon, and keep it in a stoppered bottle.*

Solution of lime is a limpid, colourless, inodorous liquid, having a disagreeable, nauseous, caustic taste, and an alkaline reaction. When exposed to the air, it absorbs carbonic acid, which at first forms a pellicle of carbonate of lime upon the surface, and, if further exposed, the whole of the lime is ultimately precipitated; hence it is necessary to keep it in constantly full and well-stoppered bottles, which are directed to be of green glass, because the lime slowly acts upon the oxide of lead of white bottles. Cold water dissolves more lime than that of a higher temperature. The addition of sugar increases the solubility of lime, so that the saccharated is much stronger than the simple solution, the latter containing only 0·56 of a grain, whilst the former contains 7·11 grains, in each ounce. The saccharated solution, being much stronger, has a more caustic and disagreeable taste than the simple solution; it also is readily converted into carbonate of lime by exposure to the atmosphere, and when two-thirds of the lime is thus changed, the solution becomes glutinous.

Dose.—Of the simple solution, half an ounce to 2 or 4 ounces, in milk, or alone; of the saccharated solution, 15 to 60 minims, well diluted; for children, 15 to 30 minims, well diluted; it may be given in milk.

Therapeutics.—Lime water acts as an antacid and astringent, and also as a sedative and lithontriptic, &c. It tends to turn the urine alkaline, and, when long continued, it interferes with the functions of digestion and secretion, and therefore should be discontinued from time to time. It has been employed as an antacid in dyspepsia with vomiting, acidity of the stomach, and cardialgia; also in gastrodynia and ulcer of the stomach; in diarrhœa, especially of children; in dysentery; as a solvent of urates, it has been given in urinary deposits, and in the dyspepsia of gouty and rheumatic subjects; as an antidote to poisoning by the mineral acids and oxalic acid. As a lotion, it has been recommended in scabies, in tinea, and other skin diseases. As an injection, in leucorrhœa, in excoriations of the vaginal mucous membrane, in pruritus. As an enema, for the expulsion of ascarides, &c. In cases of chronic vomiting, the vomiting of pregnancy, and in the chronic diarrhœa of children, the saccharated solution, well diluted, is largely used.

LINIMENTUM CALCIS—Liniment of Lime—Carron Oil.—*Take of solution of lime and olive oil, of each, 2 fluid ounces. Mix together with agitation.*

This liniment was first used at the Carron Iron Works, and hence derived its popular name; it is applied to burns and scalds, and as an antidote in poisoning by the mineral acids, oxalic acid, arsenic, &c.

Creta Preparata.—Prepared chalk freed from the most of its impurities by elutriation, and afterwards dried in small masses, which are usually of a conical form. It is carbonate of lime, $CaCO_3$, nearly pure.

Characters.—A white amorphous powder, effervescing with acids, and dissolving with only a slight residue in diluted hydrochloric acid. This solution, when supersaturated with solution of ammonia, gives, upon the addition of oxalate of ammonia, a copious white precipitate.

MISTURA CRETÆ—CHALK MIXTURE.—*Take of prepared chalk,* ¼ *ounce; gum acacia, in powder,* ¼ *ounce; syrup,* ½ *fluid ounce; cinnamon water,* 7½ *fluid ounces. Triturate the chalk and gum acacia with the cinnamon water, then add the syrup, and mix. Dose.*—½ *to* 2 ounces.

PULVIS CRETÆ AROMATICUS—AROMATIC POWDER OF CHALK.—*Take of cinnamon bark, in powder,* 4 *ounces; nutmeg, in powder, saffron, in powder, of each,* 3 *ounces; cloves, in powder,* 1½ *ounce; cardamon seeds, in powder,* 1 *ounce; refined sugar, in powder,* 25 *ounces; prepared chalk,* 11 *ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally, rub it lightly in a mortar. Keep it in a stoppered bottle. Dose.*—10 *to* 60 *grains.*

Calcii Carbonas Præcipitata ($CaCO_3$)—Precipitated Carbonate of Calcium.

PREPARATION.—*Take of chloride of calcium,* 5 *ounces; carbonate of sodium,* 13 *ounces; boiling distilled water, a sufficiency. Dissolve the chloride of calcium and carbonate of soda each in* 2 *pints of the water; mix the two solutions, and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling distilled water until the washings cease to give a precipitate with nitrate of silver, and dry the product at the temperature of* 212°.

Characters.—A white crystalline powder, insoluble in water, dissolving in hydrochloric acid with effervescence. The solution, when neutralised by ammonia, lets fall a copious white precipitate on the addition of oxalate of ammonia.

Dose.—Of creta preparata, or calcis carbonas præcipitata, 10 to 60 grains.

Therapeutics.—Prepared (or precipitated) chalk acts as an antacid, astringent, absorbent, desiccant, antidote, &c. It is given as an antacid in dyspepsia with acidity, especially when complicated with diarrhœa, and in the diarrhœa of children. Externally, it is used as a desiccant, dusted over ulcers, burns, excoriations, &c., to absorb their irritating discharges and to exclude the air. It is used as an antidote in poisoning by the mineral acids, oxalic acid, and chloride of zinc. Chalk is apt to form intestinal concretions when it is long continued; to guard against this, an occasional laxative is necessary. Mistura cretæ and pulvis cretæ aromaticus are used to check diarrhœa.

Calcii Chloridum ($CaCl_2$,2 H_2O)—Chloride of Calcium.

PREPARATION.—*It may be formed by neutralising hydrochloric acid with carbonate of calcium, adding a little solution of chlorinated lime and slaked lime to the solution, filtering, evaporating until it becomes solid, and finally drying the salt at about* 400° F. (204°·4 C.).

Characters.—In white agglutinated masses, dry, but very deliquescent, with a bitter acrid saline taste; evolves no chlorine or hypochlorous acid on the addition of hydrochloric acid, and is entirely soluble in twice its weight of water, also in alcohol.

Therapeutics.—Medicinally, chloride of calcium was formerly used in the treatment of scrofula, for the removal of glandular and other tumours, in certain chronic skin diseases, as lupus, in ovarian disease, &c. It is said to act as a stimulant of the lymphatic glandular system, and to be tonic and deobstruent. It had, however, gone greatly out of use till recommended of late years as an alterative and deobstruent in scrofula and phthisis by Dr J. W. Begbie. It well deserves increased attention. It is given in solution, beginning with small doses (gr. v, thrice a day, gradually increased to gr. xv), whilst at the same time solutions of different strength may be applied locally. Of the following solutions, which are placed in the Appendix of the Pharmacopœia as tests merely, the weaker may be given internally.

LIQUOR CALCII CHLORIDI—SOLUTION OF CHLORIDE OF CALCIUM.—*Take of chloride of calcium,* 88 *grains; distilled water,* 1 *fluid ounce; dissolve and filter. Sp. gr.* 1·145.

Dose.—15 to 50 minims.

SOLUTION (SATURATED) OF CHLORIDE OF CALCIUM.—*Take of chloride of calcium,* 4 *ounces; distilled water,* 5 *fluid ounces. Dissolve, and filter.* This is used only as a test.

OS USTUM—BONE ASH.—*The residue of bones which have been burned to a white ash in contact with air. Consists principally of phosphate of lime mixed with about* 10 *per cent. of carbonate of lime,* *and a little fluoride of calcium and phosphate of magnesia.* It is used to prepare the phosphate of lime and the phosphate of soda.

Calx Chlorinata (*see* Chlorine, page 12).

Calcii Phosphas—$Ca_3(PO_4)_2$ Phosphate of Calcium.

PREPARATION.—*Take of bone ash,* 4 *ounces; hydrochloric acid,* 6 *fluid ounces; water,* 2 *pints; solution of ammonia,* 12 *fluid ounces, or a sufficiency; distilled water, a sufficiency. Digest the bone ash in the hydrochloric acid, diluted with a pint of water, until it is dissolved. Filter the solution, if necessary; add the remainder of the water, and afterwards the solution of ammonia, until the mixture acquires an alkaline reaction; and, having collected the precipitate on a calico filter, wash it with boiling distilled water as long as the liquid which passes through occasions a precipitate when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding* 212°.

Characters.—A light white amorphous powder, insoluble in water, but soluble, without effervescence, in diluted nitric acid. The solution continues clear when an excess of acetate of soda is added to it, but lets fall a white precipitate on the subsequent addition either of a little oxalate of ammonia or of perchloride of iron.

Dose.—10 to 20 or 30 grains. Phosphate of lime may be elegantly prepared for medicinal use by dissolving it in dilute phosphoric acid, and forming it into a syrup. There are several such syrups, in which it is usually combined with phosphate of iron and other phosphates, and they are made so as to be given in tea-spoonful doses.

Therapeutics.—Phosphate of lime has been used in the treatment of rickets, mollities ossium, tabes mesenterica, scrofula, &c. It has been recommended with the view of supplying a deficiency of phosphate of lime to the system, but practically it has not succeeded.

Calcii Sulphas—Sulphate of Calcium.—Native sulphate of calcium ($CaSO_4$, $2H_2O$) rendered nearly anhydrous by heat. Introduced for the preparation of calx sulphurata.

Calx Sulphurata—Sulphurated Lime.—A mixture containing not less than 50 per cent. of sulphate of calcium (CaS).

Sulphate of calcium, 7 ounces; wood charcoal, 1 ounce; mix and heat to redness until the black colour has disappeared.

Characters.—A nearly white powder with a smell resembling that of sulphuretted hydrogen. Very slightly soluble in water, the solution rapidly decomposing with evolution of sulphuretted hydrogen.

Therapeutics.—Employed principally as a resolvent in boils, carbuncles, strumous glandular sores.

Dose.—$\frac{1}{10}$ to 1 grain.

Calcii Hypophosphis—Hypophosphite of Calcium, $Ca(PH_2O_2)_2$.—Obtained by heating phosphorus and nearly twice its weight of hydrate of calcium with water until phosphuretted hydrogen ceases to be evolved, then filtering the liquid, separating uncombined lime with carbonic acid gas, and evaporating the remaining solution until the salt separates in a crystalline condition.

Characters.—A white crystalline salt, with a pearly lustre and a bitter nauseous taste. Soluble in 6 parts of cold water and only slightly more soluble in hot water. Insoluble in cold rectified spirit. The crystals do not lose water when heated to 300° F. (148°·9 C.). Heated to redness they ignite, evolving spontaneously inflammable phosphuretted hydrogen, and leaving a red dull-coloured residue, amounting to about 80 per cent. of the salt.

Therapeutics.—The hypophosphates of calcium and sodium are supposed to exercise the beneficial effect of phosphorus without producing any of the untoward consequences of that elementary substance. They were introduced by Dr Churchill, and have been employed chiefly in philtius, but it is extremely doubtful if they produce any of the effects of free phosphorus.

Dose.—5 to 10 grains.

MAGNESIUM (Mg = 12) is a greyish-white or silvery metal, which is ductile and malleable, is fusible at a red heat, burns with an intensely brilliant white light, and is permanent in dry, but slowly oxidises in damp air.

Magnesia (MgO)—Magnesia—Oxide of Magnesium—Calcined Magnesia—occurs in two forms.

PREPARATION.—1. *Of Magnesia Powderosa: Take of carbonate of magnesium,* 4 *ounces. Put it into a Cornish or Hessian crucible, closed loosely by a lid, and expose it to a low red heat, until a small quantity, taken from the centre of the crucible, when it has cooled, and dropped into diluted sulphuric acid, causes no effervescence.*

2. *Of Magnesia Levis: Take of light carbonate of magnesium,* 4 *ounces. Put it into a Cornish or Hessian crucible, closed loosely by a lid, and expose it to a low red heat, until a small quantity taken from the centre of the crucible, when it has been cooled, and dropped into diluted sulphuric acid, causes no effervescence.*

Characters.—1. Of Magnesia: A white powder, insoluble in water, but readily dissolved by acids, without effervescence. Its solution in hydrochloric acid, when neutralised by a mixed solution of ammonia and chloride of ammonium, gives a copious crystalline precipitate when phosphate of soda is added to it.

2. Of Magnesia Levis: A bulky white powder, differing from the preceding preparation only in its greater levity, the volumes corresponding to the same weight being to each other in the ratio of three and a half to one.

Dose.—Of either kind, 10 to 20 grains as an antacid; 20 to 60 grains and upwards as a cathartic. For infants, 2 to 10 grains. It may be given suspended in milk or water.

Therapeutics.—Magnesia, in both of these forms, acts as an antacid in small doses, and as a laxative in larger doses. It combines with the acids met with in the *primæ viæ* to form purgative salts. It tends to render the urine alkaline, and to diminish the quantity of uric acid and urates. It is employed as an antacid in acidity of the *primæ viæ*, with cardialgia and gastralgia, and especially in the acidity with diarrhœa of infants. It is said also to act as a sedative in the stomach and bowels, thereby, as well as by its antacid properties, diminishing gastro-intestinal irritation. It is given to arrest the vomiting produced by irritability of the stomach, and to relieve the vomiting and cardialgia incident to pregnancy. It is given in the gouty, rheumatic, and lithic-acid diatheses. As a purgative it is not much used, except in the double capacity of antacid and laxative. When given in large quantities, or long continued, it is apt to accumulate and form concretions of considerable size in the bowels,—a result which should be obviated by the occasional use of a brisk cathartic. In the absence of other remedies, it may be used as an antidote in cases of poisoning by the mineral acids; but the great heat generated by its use renders it objectionable. It is also used as an antidote in poisoning by oxalic acid, arsenic, &c.

Magnesii Carbonas Ponderosa, $(MgCO_3)_3MgO5H_2O$—Heavy Carbonate of Magnesium.

PREPARATION.—1. *Of Carbonate of Magnesium: Take of sulphate of magnesium,* 10 *ounces; carbonate of sodium,* 12 *ounces; boiling distilled water, a sufficiency. Dissolve the sulphate of magnesia and the carbonate of soda each in a pint of the water, mix the two solutions, and evaporate the whole to perfect dryness by means of a sand-bath. Digest the residue for half an hour with* 2 *pints of the water, and, having collected the insoluble matter on a calico filter, wash it repeatedly with distilled water, until the washings cease to give a precipitate with chloride of barium Finally, dry the product at a temperature not exceeding* 212°.

MAGNESII CARBONAS LEVIS.—2. *Of Light Carbonate of Magnesium: Take of sulphate of magnesium,* 10 *ounces; carbonate of sodium,* 12 *ounces; distilled water, a sufficiency. Dissolve the sulphate of magnesium and the carbonate of sodium each in half a gallon of the water, mix the two solutions cold, and boil the mixture in a porcelain dish for fifteen minutes. Transfer the precipitate to a calico filter, and pour upon it repeatedly boiling distilled water, until the washings cease to give a precipitate with chloride of barium. Lastly, dry by a heat not exceeding* 212°.

Characters.—1. Of Carbonate: A white granular powder, which dissolves with effervescence in the diluted mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonium, but yield a copious crystalline precipitate upon the addition of phosphate of soda.

2. Of Light Carbonate: A very light powder, which, when examined under the microscope, is found to be partly amorphous, with numerous slender prisms intermixed. The other characters and tests are the same as those of carbonate of magnesia.

Dose (of either kind).—As an antacid, 10 to 20 grains; as a laxative, 20 to 60 grains, or more. It may be given suspended in milk or water, or in the form of an effervescing draught, in the proportion of 14 grains to 20 grains of citric acid.

Therapeutics.—Carbonate of magnesia, in both of these forms, acts as an antacid, absorbent, and laxative. It resembles calcined magnesia in its medicinal properties, except that in its union with acids in the *primæ viæ* it disengages carbonic acid gas, giving rise to unpleasant eructations. It is employed as an antidote in poisoning by oxalic acid.

LIQUOR MAGNESII CARBONATIS—Solution of Carbonate of Magnesia—Fluid Magnesia.

PREPARATION.—*Take of sulphate of magnesium,* 2 *ounces; carbonate of sodium,* 2½ *ounces; distilled water, a sufficiency. Dissolve the two salts separately, each in half a pint of water. Heat the solution of sulphate of magnesium to the boiling point, then add to it the solution of carbonate of sodium, and boil them together until carbonic acid ceases to be evolved. Collect the precipitated carbonate of magnesium on a calico filter, and wash it with distilled water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint of distilled water, and, putting them into a suitable apparatus, pass into it pure washed carbonic acid gas, obtained by the action of sulphuric* *acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure for about twenty-four hours, then filter the liquid to remove any undissolved carbonate of magnesia, and again pass carbonic acid gas into the filtered solution. Finally, keep the solution in a bottle, securely closed, to prevent the escape of carbonic acid. This solution contains about* 13 *grains of carbonate of magnesia in a fluid ounce.*

Characters and Tests.—Effervesces slightly, or not at all, when the containing vessel is first opened. The liquid is clear, and free from any bitter taste. A fluid ounce of it, evaporated to dryness, yields a white solid residue, which, after being calcined, weighs not less than 5 grains. This residue is insoluble in water, and answers to the tests for magnesia.

Dose.—1 to 2 fluid ounces.

Therapeutics.—The magnesia is here kept in solution by the excess of carbonic acid. It is, properly speaking, a solution of the bicarbonate (MgH_22CO_3). This salt cannot be obtained in the solid form, but in solution forms a useful medicine, known by the names given in the Pharmacopœia, as its synonyms, as well as some others, such as aërated magnesia water, &c., or distinguished by the names of the manufacturers, as Murray's, Dinneford's, Husband's fluid magnesia. It is an exceedingly agreeable form in which to prescribe magnesia ; and now that it is included in the official list, a uniform strength is secured. On the escape of the carbonic acid, hydrated carbonate of magnesia is deposited ; the solution should therefore be kept in well-stoppered bottles. Solution of bicarbonate of magnesia is used as an antacid, either alone or as an effervescing draught with nitric acid or lemon juice.

Magnesii Sulphus ($MgSO_47H_2O$)—Sulphate of Magnesium—Epsom Salts.

Sulphate of magnesium may be obtained either from *bittern* or from *dolomite.* Bittern is the liquid which remains after most of the chloride of sodium has been removed from *sea-water* by evaporation; the bittern consists chiefly of sulphate of magnesia and chloride of magnesium in solution, and by boiling this down, with the addition of sulphuric acid, the chloride is converted into sulphate, which is thus obtained. When dolomite or magnesian limestone (carbonate of lime and magnesia) is used, it is first calcined, powdered, and diffused through water ; sulphuric acid is then added to form the sulphates of lime and magnesia, from which the latter, from its ready solubility, is easily separated. From either of these sources the sulphate is subject to impurity; if from bittern, it may contain chlorides, and consequently be deliquescent; if from dolomite, it may contain iron, alumina, &c. Or it may be obtained from the native carbonate of magnesium (magnesite), by saturating it with sulphuric acid.

Characters.—In minute colourless and transparent rhombic prisms, possessing a bitter taste. It readily dissolves in water, and the solution gives copious white precipitates with chloride of barium, and with a mixed solution of ammonia, chloride of ammonium, and phosphate of soda.

ENEMA MAGNESII SULPHATIS—ENEMA OF SULPHATE OF MAGNESIUM.—*Take of sulphate of magnesium,* 1 *ounce; olive oil,* 1 *fluid ounce; mucilage of starch,* 15 *fluid ounces. Dissolve the sulphate of magnesium in the mucilage of starch, add the oil, and mix.*

Dose.—The sulphate of magnesia may be administered in doses of 60 grains to half an ounce, or more, largely diluted in water, with or without the addition of a little sulphuric acid, which renders it somewhat more palatable. It acts more effectively in proportion to its dilution. It may be given with infusion of senna, or acid infusion of roses.

A very good form for administering it also is the liquor magnesiæ sulphatis of Dr Henry of Dublin, which is prepared in the following manner:—Take of saturated solution of sulphate of magnesia, 7 ounces (equal to 4 ounces of crystals); dilute sulphuric acid, 1 ounce; mix. This is administered in doses of from one to two tablespoonfuls diluted in water. The official enema may be used in the quantity prescribed.

Therapeutics.—Sulphate of magnesia acts as a refrigerant and somewhat depressing saline cathartic, increasing the peristaltic action of the bowels, and producing watery evacuations. In small doses it is diuretic. It is a suitable purgative in the febrile and inflammatory affections of robust subjects; and in the constipation with congestion of the portal system in persons of plethoric habit. It is used as an antidote in cases of poisoning by the salts of lead and baryta, their sulphates being insoluble. It enters into the constitution of sea-water and of many mineral waters.

LIQUOR MAGNESII CITRATIS—SOLUTION OF CITRATE OF MAGNESIUM.

PREPARATION.—*Take of carbonate of magnesium,* 100 *grains; citric acid,* 200 *grains; syrup of lemons, half a fluid ounce; bicarbonate of potassium, in crystals,* 40 *grains; water, a sufficiency. Dissolve the citric acid in* 2 *ounces of the water, and, having added the carbonate of* *magnesium, stir until it is dissolved. Filter the solution into a strong half-pint bottle, add the syrup and sufficient water to nearly fill the bottle, then introduce the bicarbonate of potassium, and immediately close the bottle with a cork, which should be secured with string or wire. Afterwards shake the bottle until the bicarbonate of potassium has dissolved.*

Dose.—5 to 10 fluid ounces.

Therapeutics.—It is an agreeable and mild cooling saline cathartic.

Group III. Metals of the Earths Proper—Aluminium and Cerium.

ALUMINIUM (Al = 27·5) is a brilliant white silver-like metal, malleable and ductile; it may be obtained from its chloride by heating with sodium, or from *cryolite*, which is a double fluoride of aluminium and sodium by the same process. Specific gravity, 2·6. It is the metallic base of alumina.

Alumen—Alum—Sulphate of Aluminium and Potassium (Potassium Alum or Potassii Alum), or of Aluminium and Ammonium (Ammonium Alum or Ammonici Alum), crystallised from solution in water. $Al_2 3SO_4$, K_2SO_4,$24H_2O$ or $Al_2 3SO_4$, (NH_4), $2SO_4$, $24H_2O$.

Characters.—In colourless transparent crystalline masses, exhibiting the faces of the regular octahedron, and having an acid sweetish astringent taste. Its aqueous solution gives with caustic potash or soda a white precipitate, soluble in an excess of the reagent, and the mixture evolves ammonia, especially when heated. The aqueous solution gives an immediate precipitate with chloride of barium. It is soluble in ten or eleven parts of water at common temperatures.

ALUMEN EXSICCATUM ($Al_2 3SO_4$, K_2SO_4)—Dried Alum—Alumen Ustum.—*Take of alum,* 4 *ounces. Heat the alum in a porcelain dish, or other suitable vessel, till it liquefies, then raise and continue the heat, not allowing it to exceed* 400° F. (204°·4 C.), *till aqueous vapour ceases to be disengaged, and the salt has lost* 47 *per cent. of its weight. Reduce the residue to powder, and preserve it in a well-stoppered bottle.*

Glycerinum Aluminus—Glycerine of Alum.—*Alum,* 1 *ounce; glycerine,* 5 *fluid ounces; stir them together in a porcelain dish, gently applying heat until solution is effected. Set aside, and pour off the clear fluid from any deposited matter.*

Dose.—10 to 30 grains in solution, in pills, or as an electuary; as a gargle, 60 grains or more to 8 ounces of liquid; as a lotion, 60 grains to half an ounce to a pint of liquid, or in the form of alum whey. Dried alum is used only externally.

Therapeutics.—Alum acts as an astringent and irritant in large doses, causing vomiting and purging; in larger it is an irritant poison, causing nausea, vomiting, abdominal pain, diarrhœa, and death. Internally, it has been recommended in colica pictonum in frequently repeated doses, and in lead poisoning as a chemical antidote; in chronic diarrhœa and dysentery, and in catarrhal affections of the stomach, in which there is hypersecretion of glairy mucous and a relaxed condition of the mucous membrane; in passive hæmatemesis and hæmoptysis; in chronic hooping-cough; as an emetic in croup; in gonorrhœa, combined with cubebs; in uterine hæmorrhages, and in hæmaturia when the hæmorrhage is from the bladder, &c. As a gargle, wash, or lotion, it has been used in the relaxed states of the mucous membrane of the mouth and throat with profuse secretion of mucus, in ulcerations of the mouth and throat, and sponginess of the gums, &c.; as a collyrium in purulent ophthalmia; as an injection in ulcerations of, growths in, and hæmorrhages and discharges from, the vagina and uterus; in gonorrhœa, gleet, &c. Externally, it is applied either as a poultice, lotion, or the powder of burnt alum, to ulcers, chilblains, nævi, fungous granulations, gangrene, &c. In epistaxis it is injected into the nares; or plugs of lint, soaked in a saturated solution, are inserted; it is also applied as a hæmostatic to leech bites, wounds, hæmorrhoids, &c. By insufflation the powder of burnt alum is applied in diphtheria, inflammatory sore throat, &c.

CERIUM ($Ce = 92$).—Cerium is a rare metal, and its properties have not hitherto been well defined. Of its salts, the oxalate, CeC_2O_4, and the nitrate, $Ce2NO_3$, are used in medicine. The salts of cerium are supposed to resemble bismuth and nitrate of silver in their medicinal properties, and to act as sedatives and tonics. Only the oxalate, however, has been made official.

CERII OXALAS ($CeC_2O_43H_2O$)—The Oxalate of Cerium.

A salt which may be obtained as a precipitate by adding a solution of oxalate of ammonia to a soluble salt of cerium. It usually contains some oxalate of lanthanum and oxalate of didymium.

Characters.—A white granular powder, insoluble in water, decomposed at a dull red heat into a reddish-brown powder, which dissolves completely, and without effervescence, in boiling hydrochloric acid, and the resulting solution gives with solution of sulphate of potash a white crystalline precipitate. If the salt be boiled with solution of potash and filtered, the filtrate is not affected by solution of chloride of ammonium, but when supersaturated with acetic acid, it gives with chloride of calcium a white precipitate, which is soluble in hydrochloric acid. 10 grains when incinerated lose 5·2 grains in weight.

Dose.—1 to 2 grains, usually in the form of pill.

Therapeutics.—The oxalate of cerium was recommended by Sir James Y. Simpson in the treatment of vomiting during the earlier period of pregnancy, in the chronic vomiting attending irritable dyspepsia, and in the vomiting of phthisis ; in epilepsy, chorea, &c., it was supposed to act in these affections to a gastric sedative and nervine tonic.

GROUP IV. METALS PROPER—MANGANESE, IRON, COPPER, ZINC, CADMIUM, BISMUTH, LEAD, TIN, ANTIMONY, ARSENIC, MERCURY, SILVER, GOLD, PLATINUM.

MANGANESIUM (Mn=55).

Manganesii Oxidum Nigrum (MnO_2)—Black Oxide of Manganese—Peroxide of Manganese.

Characters.—A heavy black powder, which dissolves almost entirely in hydrochloric acid with the evolution of chlorine, and gives off oxygen when heated to redness. Used for producing chlorine and permanganate of potassium.

Potassii Permanganas (KMnO)—Permanganate of Potassium.

PREPARATION.—*Take of caustic potash,* 5 *ounces; black oxide of manganese, in fine powder,* 4 *ounces ; chlorate of potassium,* 3½ *ounces ; distilled water,* 2½ *pints; carbonic acid, a sufficiency. Reduce the chlorate of potassium to fine powder, and mix it with the oxide of manganese ; put the mixture into a porcelain basin, and add to it the caustic potash, previously dissolved in* 4 *ounces of the water. Evaporate to dryness on a sand-bath, stirring diligently to prevent spurting. Pulverise the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semi-fused mass. Let it cool, pulverise it, and boil with a pint and a half of the water. Let the insoluble matter subside, decant the fluid, boil again with half a pint of the water ; again decant, saturate the united liquors accurately with carbonic acid, and evaporate till a pellicle forms. Set aside to cool and crystallise. Drain the crystalline mass, boil it in* 6 *ounces of the water, and strain through a funnel, the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallise, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid.*

Characters.—Dark purple slender prismatic crystals, inodorous, with a sweet astringent taste, soluble in water. A single small crystal suffices to form, with an ounce of water, a rich purple solution, which, when mixed with a little rectified spirit and heated, becomes yellowish-brown. The crystals heated to redness decrepitate, evolve oxygen gas, and leave a black residue, from which water extracts potash, recognised by its alkaline reaction, and by its giving, when acidulated with hydrochloric acid, a yellow precipitate with perchloride of platinum.

The readiness with which this salt yields its oxygen is its chief peculiarity and the cause of its medicinal value. When brought into contact with organic matter and deoxidising agents generally, it gives up a portion of its oxygen, loses its brilliant colour, and is converted into the yellowish-brown hydrated peroxide of manganese referred to in the *Characters.* A standard solution of the permanganate is used to determine the quantity of organic matter present in air and water, the quantity being in direct proportion to the loss of colour. The permanganate has been largely introduced as a deodoriser and disinfectant, under the title of *Condy's Disinfecting Fluid* and *Condy's Ozonised Water.*

LIQUOR POTASSII PERMANGANATIS—SOLUTION OF PERMANATE OF POTASSIUM.—*Take of permanganate of potash,* 88 *grains; distilled water,* 1 *pint; dissolve. Dose* 2 *to* 4 *fluid drachms.*

Dose.—1 to 5 grains, simply dissolved in distilled water so as to avoid decomposition by organic matters, or 2 to 4 fluid drachms of the liquor. Externally, as a caustic application, the powder may be sprinkled over sores, or strong solutions may be applied; as a purifiying lotion or gargle, 2 or more drachms of the official solution in 8 or 10 ounces of distilled water. For purifying apartments, water-closets, &c., *Condy's Disinfectant Fluid,* which is about twice as strong, though less pure than the official solution, may be employed, exposed in open vessels, or sprinkled on the floor.

Therapeutics.—Permanganate of potash is chiefly used as an escharotic, disinfectant, antiseptic, and deodorising agent, for the cleansing of gangrenous, cancerous, and other foul ulcers and wounds; as a gargle and wash for the mouth and throat, in ulcerations with fetid discharges from these parts; as an injection in fetid discharges from the vagina, &c. It may be given internally as a deodoriser of the breath and sputa in cases of phthisis, gangrene of the lungs, &c.; and to purify the alvine dejections in dysentery, typhoid fever, &c. It is also extensively used as a deodoriser of sick-rooms, water-closets, cesspools, &c.

FERRUM (Fe=56)—Iron—the *Mars*, ♀, of the alchemists—was probably the first used of any of the minerals in medicine. It occurs largely both in the inorganic and organic worlds, both in the free state and combined in a variety of forms. Iron exists in the blood, and is believed to be an essential constituent of it, without which life could not be sustained ; its presence in sufficient quantity being indicated by the ruddy appearance of the cheeks and lips in health, whilst a deficiency is marked by paleness and other symptoms of disease. As a remedy, iron is inert in the metallic state, and it is only when it is rendered soluble by oxidation and conversion into salts (either before its administration, or by the gastric fluid) that it becomes useful. The preparations of iron exercise a twofold action —one immediate or primary, the other secondary. Their immediate action, varying according to the preparations employed, and chiefly manifested by the persalts, is generally stimulant and astringent of the parts to which they are applied, stimulating the appetite and improving the digestion. The preparations which produce this effect are contra-indicated in those cases in which there is irritability of the stomach, with a tendency to constipation, both of which they would increase ; but they are used advantageously in cases of hyper-secretions, passive hæmorrhages, and the like. The secondary, the true chalybeate or hematinic, action of the ferruginous preparations is manifested slowly, after the medicine has been given in moderate doses for a considerable time, and consists in the enrichment of the blood by the increase in the number of its red particles. The function of iron in the blood appears to be as an oxidising agent because under its administration the pulse is strengthened and quickened, the temperature is raised, and the amount of urea excreted is increased. The milder protosalts are commonly used for this purpose, because their employment is usually indicated in the cases of delicate females and children suffering from anæmia, scrofula, &c., whose stomachs are weak and irritable, and would not bear the stronger preparations. When employed in unsuitable cases, or when pushed too far, chalybeates are apt to cause uneasiness, by inordinately exciting the circulatory system, giving rise to general plethora, and a complaint on the part of the patient of fulness in the head, singing in the ears, throbbing in the temples, headache, and general feverish excitement ; and when the astringent preparations are unduly exhibited, there may be uneasiness and pain in the stomach and bowels, possibly attended by vomiting and diarrhœa. Ferruginous preparations are contra-indicated in persons of plethoric habit of body, and in active inflammatory and hæmorrhagic cases.

They tend to constipation, and to blacken the alvine evacuations, the latter of which circumstances, if unexplained, may cause uneasiness in the mind of the patient. The colour is due to the formation of tannate and sulphuret of iron, due to the combination of the iron with the tannin and sulphur obtained from the food and intestinal gases. When the ferruginous preparations are administered chiefly for the sake of their tonic and astringent properties, it is better to give them in moderate doses upon an empty stomach; but when given as chalybeates it is better to give them with food. Besides the conditions already adverted to, the ferruginous preparations are employed in dyspepsia; in heart disease; in affections of the urinary organs, liver, and spleen; in dropsies; in fevers, &c., the chief of which will be mentioned under the several preparations.

Ferrum—Iron.—1. Wrought iron, in the form of wire or nails free from oxide. 2. Iron filings. Iron filings may be procured from the blacksmith's shop; they may be obtained in a state of tolerable purity by means of a magnet, but even then they contain adherent impurities. The readiest method of procuring them uncontaminated is by filing a piece of clean wrought-iron over a sheet of paper. Iron filings are rarely used internally; but were formerly given for the cases in which the soluble preparations are now commonly administered.

Ferrum Redactum—Reduced Iron—Ferri Pulvis—Fer Reduit.—Metallic iron with a variable amount of magnetic oxide of iron.

PREPARATION.—*Take of strong solution of perchloride of iron, solution of ammonia, zinc granulated, sulphuric acid, chloride of calcium, distilled water, of each a sufficiency; dilute the strong solution of perchloride of iron with* 5 *volumes of water; pour the mixture into such a quantity of solution of ammonia, diluted with* 5 *volumes of water, that the whole, after thorough stirring, has a distinct odour of ammonia. Wash the precipitated ferric hydrate until the washings are no longer rendered cloudy by solution of nitrate of silver; dry the precipitate. Introduce the resulting ferric oxyhydrate into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas developed by the action on the zinc of some of the sulphuric acid, diluted with eight times its volume of water. The gas, before entering the gun-barrel, must be rendered quite dry, by being made to pass first through the remainder of the sulphuric acid, and then through a tube* 18 *inches long, packed with small fragments of the chloride of calcium. The further end of the gun-*

barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the sulphuric acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen still being continued. The reduced iron is then to be withdrawn, and inclosed in a dry stoppered bottle.

Characters.—A fine greyish-black powder, strongly attracted by the magnet, and exhibiting metallic streaks when rubbed with firm pressure in a mortar. It dissolves in hydrochloric acid with the evolution of hydrogen, and the solution gives a light-blue precipitate with the yellow prussiate of potash.

Therapeutics.—This preparation is a pure chalybeate and hematinic. Very useful in anæmia, because it is tasteless and unirritating, and readily taken by children and by those of delicate stomach, it is dissolved in the stomach and so becomes active.

Dose.—2 to 10 grains in powder or pill.

Trochisci Ferri Redacti—Lozenges of Reduced Iron.

PREPARATION.—*Take of reduced iron,* 720 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce, or a sufficiency. Mix the iron, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains* 1 *grain of reduced iron.*

Dose.—1 to 6 lozenges occasionally.

Ferri Peroxidum Hydratum, $Fe_2O_3H_2O$ or $Fe_2O_2(HO)_2$—Hydrated Peroxide of Iron.

PREPARATION.—*Take of solution of persulphate of iron,* 4 *fluid ounces; solution of soda,* 33 *fluid ounces; distilled water, a sufficiency. Mix the solution of persulphate of iron with* 1 *pint of the distilled water; add this gradually to the solution of soda, stirring them constantly and briskly. Dry it in a temperature not exceeding* 212° F. (100° C.) *until it ceases to lose weight, then reduce to a fine powder.*

Characters.—A reddish-brown powder, destitute of taste, and not magnetic, it dissolves completely, though slowly, with the aid of heat, in hydrochloric acid diluted with half its volume of water, and the solution gives a copious precipitate with the yellow, but none with the red prussiate of potash. Heated to dull redness in a test tube, it gives off moisture.

PREPARATION.—*Emplastrum Ferri.*

EMPLASTRUM FERRI—CHALYBEATE PLASTER—EMPLASTRUM ROBORANS.—*Take of peroxide of iron, in fine powder,* 1 *ounce; Burgundy pitch,* 2 *ounces; lead plaster,* 8 *ounces. Add the peroxide of iron to the Burgundy pitch and lead plaster, previously melted together, and stir the mixture constantly till it stiffens on cooling.*

Dose.—20 to 60 grains, or more, in powder or electuary: it may be given in the cases in which ferruginous tonics and chalybeates are indicated, but its use is chiefly confined to the treatment of neuralgia, especially tic-douloureux. The plaster is employed in lumbago, rheumatic pains, weak joints, &c., as a mechanical support, and to afford warmth.

Liquor Ferri Dialysatus—Solution of Dialysed Iron.—This solution of dialysed iron, so called, is a solution of highly basic ferric oxychloride or chloroxide of iron, from which most of the acidulous matter has been removed by dialysis.

PREPARATION.—*Mix* 6 *ounces of solution of perchloride of iron with* 2 *pints of distilled water, stir into the mixture sufficient diluted solution of ammonia to impart after agitation a distinct ammoniacal odour. Filter through calico and wash the precipitate with distilled water. Add the precipitate to the remainder of the perchloride of iron solution, stir, warm gently, and, when solution is effected, filter if necessary, and place the liquid in a covered dialyser; then subject it to a stream of water in the usual manner, until the solution on the dialyser is almost tasteless. The resulting solution should measure* 28 *fluid ounces.*

Characters.—A clear dark reddish-brown liquid, free from any marked ferruginous taste, neutral to test paper; sp. gr. about 1·407. The solution gives no precipitate with ferrocyanide of potassium or nitrate of silver, but after being heated with hydrochloric acid it yields with ferrocyanide of potassium a blue precipitate. 100 grains by weight affords a precipitate with a solution of ammonia, which, washed, dried, and ignited, weighs 5 grains.

Dose.—10 to 30 minims.

Therapeutics.—A mild, not irritating, and efficient hæmatinic.

Ferri Perchloridi Liquor Fortior—Strong Solution of Perchloride of Iron.

PREPARATION.—*Take of iron wire,* 4 *ounces; hydrochloric acid,* 20½ *fluid ounces; nitric acid,* 12 *fluid drachms; distilled water, a sufficiency. Mix* 8 *fluid ounces of the hydrochloric acid with the distilled water, and in this dissolve the iron at a gentle heat. Filter the solution, add to it the remainder of the hydrochloric acid and the nitric acid, heat the mixture briskly, until, on the sudden evolution of red fumes, the liquid* *becomes of an orange-brown colour, then evaporate by the heat of a water-bath until it is reduced to* 10 *fluid ounces.*

Characters.—An orange-brown solution, with a strong styptic taste; miscible with water and rectified spirit in all proportions. Diluted with water, it is precipitated white by nitrate of silver and blue by yellow prussiate of potash, but not at all by red prussiate of potash.

LIQUOR FERRI PERCHLORIDI—Solution of the Perchloride of Iron.

The same strength as tincture of perchloride of iron.

Preparation.—*Take of strong solution of perchloride of iron,* 5 *fluid ounces; distilled water,* 20 *fluid ounces. Mix.*

Dose.—10 to 30 minims.

Therapeutics.—This preparation is cheaper, keeps very much better, and possesses all the medicinal virtues of the tincture, with the exception of not being so powerful a local astringent or irritant. It ought, therefore, eventually to supersede the latter entirely.

TINCTURA FERRI PERCHLORIDI—Tincture of Perchloride of Iron—Tinctura Ferri Sesquichloridi—Tinctura Ferri Muriatis.—*Take of strong solution of perchloride of iron,* 5 *fluid ounces; rectified spirit,* 5 *fluid ounces; distilled water,* 10 *fluid ounces. Mix, and then add sufficient distilled water to make* 1 *pint; preserve in a stoppered bottle.* Test.—*Specific gravity,* 0·992. *This tincture has about one-third of the strength of Tinctura Ferri Sesquichloridi,* Dub.

Dose.—Of the strong solution, 2 to 10 drops, well diluted; of the tincture or the solution, 10 to 40 drops, well diluted with water or syrup. For injecting into aneurisms, varices, or nævi, solutions of various strengths (5 to 20 grains to a drachm of distilled water) are employed.

Therapeutics.—Both the solutions and the tincture of perchloride of iron act as powerful astringents, styptics, hæmostatics, and tonics, and undiluted, as escharotics. In excessive doses the tincture has occasionally proved fatal, and frequently highly injurious, the symptoms and treatment resembling those of poisoning by hydrochloric acid. It has been criminally used to induce abortion. Liquor Ferri Perchloridi Fortior is rarely used internally, the tincture, which is one-fourth of its strength, being commonly employed, but it may safely be given in pregnancy and anæmia, in medicinal doses, as it has no direct action on the uterus. It has been proposed to treat aneurisms by injecting them with strong solutions of the perchloride of iron; but the practice is highly dangerous. Varicose veins, varicose ulcers, and nævi have been treated in a similar manner. As an escharotic and hemostatic, the strong solution is applied to ulcerated surfaces, hospital gangrene, cancerous and fungous ulcerations, uterine polypi, hæmorrhoidal tumours, or a solution in glycerine to stop bleeding from oozing surfaces. In post-partum hæmorrhage its use has been strongly advocated by Dr Barnes and others. But, when so employed, it must be remembered that its use entails risk of embolism, or of metritis; so that it is only allowable in desperate cases. The *Tincture* is also used as a hemostatic, to arrest capillary hæmorrhage, to stop the bleeding of leech bites, and that following the extraction of teeth; and, as a milder caustic, it is applied to simple and venereal warts, to ulcerated surfaces, spongy granulations, ulcerated throat, diphtheria, &c. Internally, the tincture is one of the most frequently used preparations of iron; it is employed as a tonic and chalybeate, but it is also somewhat of a diuretic. It is used in relaxed and atonic states of the system when there is no irritability of the alimentary mucous membrane; in the night sweats and debility of phthisis; in passive hæmorrhages and mucous discharges from the genito-urinary organs, as in hæmaturia, leucorrhœa, gleet, &c.; also in the affections of the urinary organs, as in irritable bladder, spasmodic retention, and in the incontinence of children. In erysipelas the tincture is given in doses of 15 to 25 minims, repeated every two or three hours. As a tonic and chalybeate, it is given in chlorosis, anæmia, albuminuria, diabetes, &c. The bowels must be relieved from the constipation which it produces.

Ferri Pernitratis Liquor—Solution of Pernitrate of Iron.

PREPARATION.—*Take of fine iron wire, free from rust,* 1 *ounce; nitric acid,* 4½ *fluid ounces; distilled water, a sufficiency. Dilute the nitric acid with* 16 *ounces of the water, introduce the iron wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more distilled water. Filter the solution, and add to it as much distilled water as will make its bulk one pint and a half.*

Characters.—A clear solution, of a reddish-brown colour, slightly acid and astringent to the taste; gives a blue precipitate with the yellow prussiate of potash. When to a little of it placed in a test-tube half its volume of pure sulphuric acid is added, and then a solution of sulphate of iron is poured on, the whole assumes a dark-brown colour.

Therapeutics.—10 to 40 minims, sufficiently diluted with water. Pernitrate of iron acts as a tonic, astringent, and escharotic. It is given in chronic diarrhœa and in dysentery, both by the stomach and as an injection with mucilage of starch; in the colliquative diarrhœa and sweating of phthisis; in lienteric diarrhœa, in the diarrhœa of nervous debilitated females; in passive hæmorrhages from the stomach, intestines (especially if in the course of typhoid fever), uterus, urinary organs, or lungs; in chronic mucous discharges, &c., but is probably inferior to the liquor perchloride.

Ferri Sulphas ($FeSO_4 7H_2O$)—Sulphate of Iron—Green Vitriol.

PREPARATION.—*Of Ferri Sulphas: Take of iron wire,* 4 *ounces; sulphuric acid,* 4 *fluid ounces; distilled water,* 1½ *pint. Pour the water on the iron placed in a procelain dish, add the sulphuric acid, and when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle.*

Ferri Sulphas Granulata.

PREPARATION.—*Take of iron wire,* 4 *ounces; sulphuric acid,* 4 *fluid ounces; distilled water,* 1½ *pint; rectified spirit,* 8 *fluid ounces. Pour the water on the iron placed in a porcelain capsule, add the sulphuric acid, and, when the disengagement of gas has nearly ceased, boil for ten minutes, and then filter the solution into a jar containing the spirit, stirring the mixture so that the salt shall separate in minute granular crystals. Let these, deprived by decantation of adhering liquid, be transferred on filtering paper to porous tiles, and dried by exposure to the atmosphere. They should be preserved in a stoppered bottle.*

Characters.—Of Ferri Sulphas: In oblique rhombic prisms, of a pale greenish-blue colour and styptic taste; insoluble in rectified spirit, soluble in water.

Characters.—Of Ferri Sulphas Granulata: In small granular crystals of a pale greenish-blue colour. In other respects corresponds to characters and tests for sulphate of iron.

FERRI SULPHAS EXSICCATA—DRIED SULPHATE OF IRON ($FeSO_4 H_2O$).—*Take of sulphate of iron,* 4 *ounces. Expose it in a porcelain or iron dish to a temperature of* 212° F. (100° C.), *until aqueous vapour ceases to be given off. Reduce the residue to a fine powder, and preserve it in a stoppered bottle.* The sulphate loses six of its seven atoms of water by this process. The dried sulphate occurs as a yellowish-white powder, and is much less bulky than the sulphate.

Dose.—Of the sulphate, or granulated sulphate, 1 to 5 grains, in pill or solution; of the dried sulphate, $\frac{1}{2}$ grain to 2 or 3 grains.

Pilula Aloes et Ferri—Pill of Aloes and Iron.

PREPARATION.—*Take of sulphate of iron,* $1\frac{1}{2}$ *ounce; Barbadoes aloes, in powder,* 2 *ounces; compound powder of cinnamon,* 3 *ounces; confection of roses,* 4 *ounces. Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and, adding the confection, make the whole into a uniform mass.*

Dose.—5 to 10 grains.

Therapeutics.—This mass combines the purgative properties of the aloes with the chalybeate of the iron, the latter ingredient seeming to increase the action of the aloes. It is useful as an emmenagogue in atonic amenorrhœa and chlorosis, and as a purgative in anæmia in general.

Sulphate of iron in excessive doses may act as an irritant poison; and it has been used criminally to produce abortion; in large medicinal doses it may cause irritability of stomach. It acts as a tonic, astringent, hematinic, hemostatic, &c., and is given in those cases in which both the tonic and true chalybeate effects of iron are required, as in anæmia, chlorosis, and general debility; in passive hæmorrhages, profuse discharges, chronic diarrhœa, &c., and in neuralgia; and it is given in enlargement of the spleen. Externally in the form of lotion, the sprinkled powder, or ointment, it is applied to ulcerated surfaces, chronic ophthalmia, erysipelas, &c. As an injection, it is used in leucorrhœa, gleet, prolapse of the rectum, &c.

Liquor Ferri Persulphatis—Solution of the Persulphate of Iron —Solution of Ferric Sulphate.

PREPARATION.—*Take of sulphate of iron,* 8 *ounces; sulphuric acid and nitric acid, of each,* 6 *fluid drachms; distilled water,* 12 *fluid ounces, or a sufficiency. Add the sulphuric acid to* 10 *ounces of the water, and dissolve the sulphate of iron in the mixture with the aid of heat. Mix the nitric acid with the remaining* 2 *ounces of the water, and add the dilute acid to the solution of sulphate of iron. Concentrate the whole by boiling, until, by the sudden disengagement of ruddy vapours, the liquid ceases to be black, and acquires a red colour. A drop of the solution is now to be tested with red prussiate of potash; and if a blue precipitate forms, a few additional drops of nitric acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity* 11 *fluid ounces, by the addition, if necessary, of distilled water.*

Characters.—A dense solution of a dark-red colour, inodorous and very astringent, miscible in all proportions with alcohol and water.

Therapeutics.—This preparation is not used internally, but is employed in forming the following compounds:—Ferri et Ammoniæ Citras; Ferri et Quiniæ Citras; Ferri Oxidum Magneticum; Ferri Peroxidum Humidum; Ferrum Tartaratum; Tinctura Ferri Acetatis.

Ferri Carbonas Saccharata—Saccharated Carbonate of Iron—Carbonate of Iron (or $FeCO_3$) mixed with Peroxide of Iron and Sugar, and forming about one-third of the mixture.

PREPARATION.—*Take of sulphate of iron,* 2 *ounces; carbonate of ammonium,* $1\frac{1}{4}$ *ounce; boiling distilled water,* 2 *gallons; refined sugar,* 1 *ounce. Dissolve the sulphate of iron and the carbonate of ammonium each in half a gallon of the water, and mix the two solutions with brisk stirring in a deep cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate which has subsided separate the supernatant solution by a siphon. Pour on the remainder of the water, stir well, and after subsidence again remove the clear solution. Collect the resulting carbonate in a calico filter, and, having first subjected it to expression, rub it with the sugar in a porcelain mortar. Finally, dry the mixture at a temperature not exceeding* 212° F. (100° C.).

Characters.—Small coherent lumps of a grey colour, with a sweet, very feeble chalybeate taste. Dissolves, with effervescence, in warm hydrochloric acid, diluted with half its volume of water.

MISTURA FERRI COMPOSITA—COMPOUND MIXTURE OF IRON—GRIFFITH'S MIXTURE.—*Take of sulphate of iron,* 25 *grains; carbonate of potassium,* 30 *grains; myrrh and refined sugar, of each,* 60 *grains; spirit of nutmeg,* 4 *fluid drachms; rose water,* $9\frac{1}{2}$ *fluid ounces. Reduce the myrrh to powder, add the carbonate of potassium and sugar, and triturate them with a small quantity of the rose water, so as to form a thin paste; then gradually add more rose water and the spirit of nutmeg, continuing the trituration and further addition of rose water until about eight fluid ounces of a milky liquid is formed. Then add the sulphate of iron dissolved in the remainder of the rose water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air.*

PILULA FERRI CARBONATIS—PILL OF CARBONATE OF IRON.—*Take of saccharated carbonate of iron,* 1 *ounce; confection of roses,* $\frac{1}{4}$ *ounce. Beat them into a uniform mass.*

Dose.—Of the saccharated carbonate, in powder or electuary, 5 to

30 grains; of the compound mixture, 1 ounce to 2 ounces; of the pill, 5 to 20 grains.

Therapeutics.—Carbonate of iron acts as a mild non-astringent chalybeate, suitable for females and children. It resembles the peroxide in medicinal properties, and, like it, is useful in neuralgia. Griffith's mixture is largely used in anæmia, chlorosis, and amenorrhœa, &c. The myrrh and nutmeg render it somewhat stimulant. Carbonate of iron, held in solution by excess of carbonic acid, is the chief constituent of many chalybeate waters; on the escape of the dissolving carbonic acid, the carbonate is resolved into sesquioxide, which gives the ochry appearance to the soil in the vicinity of these springs.

Ferri Phosphas—Phosphate of Iron—Blue Phosphate of Iron—Ferrous Phosphate, $Fe_3(PO_4)_2 8H_2O$, at least 47 per cent.; with ferric phosphate and some oxide.

PREPARATION.—*Take of sulphate of iron,* 3 *ounces; phosphate of sodium,* 2¾ *ounces; bicarbonate of sodium,* ¾ *ounce; boiling distilled water, a sufficiency. Dissolve the sulphate of iron in* 30 *ounces of water and the phosphate of sodium in a similar quantity of water. When each solution has cooled to between* 100° *and* 130° F. (37°·8 *and* 54°·4 C.) *add the latter to the former, pouring in also a solution of the bicarbonate of sodium in a little distilled water. Mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with hot distilled water till the filtrate ceases to give a precipitate with chloride of barium. Finally, dry the precipitate at a temperature not exceeding* 120° F. (48°·9 C.).

Characters.—A slate-blue amorphous powder, insoluble in water, soluble in hydrochloric acid. The solution yields a precipitate with both the yellow and red prussiate of potash, that afforded by the latter being the more abundant, and when treated with tartaric acid and an excess of ammonia, and subsequently with the solution of ammonio-sulphate of magnesia, lets fall a crystalline precipitate.

SYRUPUS FERRI PHOSPHATIS—SYRUP OF PHOSPHATE OF IRON.—*Take of granulated sulphate of iron,* 224 *grains; phosphate of sodium,* 200 *grains; bicarbonate of sodium,* 56 *grains; concentrated phosphoric acid,* 1¼ *fluid ounce; refined sugar,* 8 *ounces; distilled water,* 8 *fluid ounces. Dissolve the sulphate of iron in* 4 *ounces of boiling water, and the phosphate of sodium in a similar quantity of cold water. Mix the solution, then add the bicarbonate of sodium dissolved in a little water, and after careful stirring transfer the precipitate to a calico filter and wash it with distilled water till the filtrate ceases to be affected by chloride of barium. Mix the residue on the filter, in a mortar with the* *phosphoric acid. As soon as the precipitate is dissolved, filter the solution, add the sugar, and dissolve without heat. The product should measure exactly* 12 *fluid ounces. It contains* 1 *grain of phosphate of iron,* $Fe_3(PO_4)_2$, *in* 1 *fluid drachm.*

Dose.—Of the powder, 3 to 10 grains, in powder or pill, or dissolved in diluted phosphoric acid, sufficiently diluted ; of the syrup, from 20 minims to a drachm, well diluted, each drachm containing 1 grain of phosphate of iron, and about half a drachm of diluted phosphoric acid.

Therapeutics.—Phosphate of iron has been recommended as a mild chalybeate, and is said to be useful, in consequence of its combination with phosphoric acid, in cases of anæmia, chlorosis, &c., in conjunction with scrofula and rickets ; in cases complicated with great nervous exhaustion and depression of spirits, and where there is a tendency to deposits of phosphates in the urine ; it has also been recommended in diabetes ; but it is simply useful as a preparation of iron and not of phosphorus, the latter being only active in its elemental form and not as phosphoric acid, at least as a nervous tonic, or to promote the growth of the bony skeleton (WEGNER). Several phosphates have been used in medicine, and a variety of syrups have been prepared, such as syrup of the phosphate of iron and lime, syrup of the phosphate of iron and ammonia, syrup of pyrophosphate of iron, syrup of superphosphate of iron, &c. Parrish's compound syrup of phosphates contains, in a teaspoonful, 2½ grains of phosphate of lime, 1 grain of phosphate of iron, with parts of a grain of phosphates of soda and potash, in addition to free phosphoric and hydrochloric acids. This and the above syrups may be given in doses of from 30 drops to a teaspoonful.

Ferrum Tartaratum ($KFeC_4H_4O_7$)—Tartarated Iron—Tartarate of Iron and Potassium.

PREPARATION.—*Take of solution of persulphate of iron,* 6 *fluid ounces; solution of ammonia,* 11 *fluid ounces ; acid tartrate of potassium in powder,* 2 *ounces ; distilled water, a sufficiency. Mix the solution of ammonia with* 3 *pints of distilled water, and to this add gradually the solution of persulphate of iron, previously diluted with* 2 *pints of distilled water, stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally ; then put it on a calico filter ; and when the liquor has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the washed and drained precipitate* *intimately with the acid tartarate of potassium, in a procelain dish, and let the mixture stand for twenty-four hours; then, having applied a gentle heat, not exceeding* 140° F. (60° C.), *add gradually a pint of distilled water, and stir constantly until nothing more will dissolve. Filter, evaporate, at a temperature not exceeding* 140° F. (60° C.), *to the consistence of syrup, and dry it in layers, on flat porcelain or glass plates, in a drying-closet, at not much above* 100° F. (37°·8 C.). *Remove the dry salt in flakes, and keep it in stoppered bottles.*

Characters.—Thin transparent scales, of a deep garnet colour, slightly sweetish and astringent in taste, soluble in water, and sparingly soluble in spirit. The aqueous solution, when acidulated with hydrochloric acid, gives a copious blue precipitate with the yellow, but none with the red prussiate of potash. When the salt is boiled with a solution of soda, peroxide of iron separates, but no ammonia is evolved, and the filtered solution, when slightly acidulated by acetic acid, gives, as it cools, a crystalline deposit.

VINUM FERRI—Wine of Iron.—*Take of fine iron wire (about No.* 35), 1 *ounce; sherry,* 1 *pint. Macerate for thirty days in a closed vessel, the iron being almost but not quite wholly immersed in the wine, and the vessel frequently shaken and the stopper removed; then filter.*

Dose.—Of the salt, 5 to 15 grains, in solution or electuary; of the wine, 1 to 4 fluid drachms.

Therapeutics.—Tartarated iron acts as a mild chalybeate and tonic, and somewhat as a diuretic. It is given to delicate females and children.

Ferri et Ammonii Citras ($NH_4FeHC_6H_5O_8H_2O$)—Citrate of Iron and Ammonium—Ammonio-Citrate of Iron.

Preparation.—*Take of solution of persulphate of iron,* 10 *fluid ounces; solution of ammonia,* 23 *fluid ounces; citric acid,* 4 *ounces; distilled water, a sufficiency. Mix* 16 *fluid ounces of the solution of ammonia with* 2 *pints of distilled water, and to this add gradually the solution of persulphate of iron, previously diluted with* 2 *pints of distilled water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally; then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Dissolve the citric acid in* 4 *ounces of distilled water, and, having applied the heat of a water-bath, add the ferric hydrate previously well drained, and stir them together until the whole or nearly the whole of the hydrate has dissolved. Let the solution cool; then add* 5½ *fluid ounces of solution of ammonia. Filter through flannel;*

evaporate to the consistency of syrup, and dry it in thin layers, on flat porcelain or glass plates, at a temperature not exceeding 100° F. (37°·8 C.). *Remove the dry salt in flakes, and keep it in a stoppered bottle.*

Characters.—In thin transparent scales of a deep red colour, slightly sweetish and astringent in taste; it feebly reddens litmus paper, is soluble in water, but almost insoluble in rectified spirit. Heated with solution of potash, it evolves ammonia and deposits ferric hydrate. The alkaline solution from which the iron has separated does not, when slightly supersaturated with acetic acid, give any crystalline deposit.

Dose.—3 to 8 grains, in solution.

Therapeutics.—Citrate of iron and ammonia acts as a mild non-astringent chalybeate, given to delicate females and children.

Vinum Ferri Citratis—Wine of the Citrate of Iron.

PREPARATION.—*Take of citrate of iron and ammonium,* 160 *grains; orange wine,* 1 *pint; dissolve, and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter.*

Therapeutics.—An excellent chalybeate, much less likely to decompose than the Vinum Ferri.

Dose.—1 to 4 fluid drachms.

FERRI ET QUININÆ CITRAS—Citrate of Iron and Quinina—Citric Acid combined with Peroxide of Iron, Protoxide of Iron, and Quinine.

PREPARATION.—*Take of solution of persulphate of iron,* 4½ *fluid ounces; sulphate of quinine,* 1 *ounce; diluted sulphuric acid,* 12 *fluid drachms; citric acid,* 3 *ounces and* 30 *grains; solution of ammonia, distilled water, of each, a sufficiency. Mix* 8 *fluid ounces of the solution of ammonia with* 2 *pints of distilled water, and to this add the solution of persulphate of iron, previously diluted with* 2 *pints of distilled water, stirring them constantly and briskly. Let the mixture stand for* 2 *hours, stirring it occasionally. Then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Mix the sulphate of quinine with* 8 *ounces of distilled water, add the diluted sulphuric acid, and when the salt is dissolved, precipitate the quinine with a slight excess of solution of ammonia. Collect the precipitate on a filter, and wash it with a pint and a half of distilled water. Dissolve the citric acid in* 5 *ounces of distilled water, and having applied the heat of a water-bath, add the ferric hydrate, previously well drained; stir them together, and when the hydrate has dissolved, add the precipitated quinine, continuing the agitation until this also has dis-*

solved. Let the solution cool, then add, in small quantities at a time, 12 fluid drachms of solution of ammonia, diluted with 2 fluid ounces of distilled water, stirring the solution briskly, and allowing the quinine, which separates with each addition of ammonia, to dissolve before the next addition is made. Filter the solution, evaporate to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates, at a temperature of 100° F. (37°·8 C.). *Remove the dry salt in flakes, and keep it in a stoppered bottle.*

Characters.—Thin scales of a greenish golden-yellow colour, somewhat deliquescent, and entirely soluble in cold water. The solution is very slightly acid, and is precipitated reddish-brown by solution of soda, white by solution of ammonia, blue by the yellow and red prussiates of potash, white and greyish-black by tannic acid.

Dose.—3 to 8 or 10 grains. The citrate of iron, and quinina acts, in the double capacity of its united constituents, as a non-astringent chalybeate and tonic. It is not, however, a very satisfactory preparation, as it does not always contain its proper proportion of quinine.

Liquor Ferri Acetatis Fortior.—Strong solution of acetate of iron. Ferric hydrate (prepared by precipitating a solution of persulphate of iron with ammonia) is dissolved in glacial acetic acid, and diluted with sufficient distilled water to give a solution of sp. gr. 1·127.

Characters.—A deep red fluid with a sour styptic taste and acetous odour, miscible with water and rectified spirit in all proportions sp. gr. 1·127. A fluid drachm diluted with 2 fluid ounces of water, gives with excess of ammonia a reddish-brown precipitate, which, when washed and ignited, weighs 5·7 grains.

Dose.—1 to 8 minims.

Liquor Ferri Acetatis.—Solution of acetate of iron (strong solution of acetate of iron, 5 fluid ounces ; distilled water sufficient to produce, after admixture, 20 fluid ounces) sp. gr. 1·031.

Dose.—5 to 30 minims.

Tinctura Ferri Acetatis.—Tincture of acetate of iron (strong solution of acetate of iron, 5 fluid ounces ; acetic acid, 1 fluid ounce; rectified spirit, 5 fluid ounces ; distilled water, 9 fluid ounces.) Mix, then add sufficient distilled water to make 1 pint. The same strength as the solution of acetate of iron.

Dose.—5 to 30 minims.

Therapeutics.—A useful hæmatinic.

Mistura Ferri Aromatica—Aromatic Mixture of iron.

PREPARATION.—*Take of red cinchona bark, in powder,* 1 *ounce; calumba root, in coarse powder,* ½ *ounce; cloves, bruised,* ¼ *ounce; fine iron wire,* ½ *ounce; compound tincture of cardamons,* 3 *fluid ounces; tincture of orange peel,* ½ *fluid ounce; peppermint water, a sufficiency. Macerate the cinchona bark, calumba root, cloves, and iron, with* 12 *fluid ounces of the peppermint water, in a closed vessel, for* 3 *days, agitating occasionally; then filter the liquid, adding as much peppermint water to the filter as will make the product measure* 12½ *fluid ounces; to this add the tinctures, and preserve in a well-stoppered bottle.*

Dose.—1 to 2 fluid ounces.

Therapeutics.—This is a somewhat unchemical and unsightly preparation, but enjoys a great reputation in Dublin as an excellent tonic and chalybeate. From the name of its author, as well as on account of its appearance, it is sometimes called Heberden's Ink; but it contains such a small quantity of iron, that, medicinally, it can only be considered a tonic and stomachic.

CUPRUM (Cu=64·4)—Copper—the *Venus*, ♀ of the alchemists—was known in the early ages. Copper, which derives its name from the island of Cyprus, or Κύπρος, where it was first wrought by the Greeks, occurs both in the inorganic and the organic world; in the latter it is found in the ashes of many plants, and in the former it is met with in various states of combination, especially in the form of sulphides, from which the copper of commerce is chiefly derived. Fine copper wire, about No. 25 wire gauge, or about 0·02 inch, is contained in the Pharmacopœia, and copper foil—pure metallic copper, thin and bright—is placed in the Appendix. It is a red lustrous metal, malleable and ductile; it emits a peculiar odour when warmed or rubbed, and has an average specific gravity of 8·93.

Cupri Sulphas ($CuSO_4 5H_2O$)—Sulphate of Copper—Blue Stone—Blue Vitriol.

PREPARATION.—*May be obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution until crystallisation takes place on cooling, or by dissolving black oxide of copper in hot diluted sulphuric acid, filtering, evaporating, and crystallising.*

Characters.—A blue crystalline salt, in oblique prisms, soluble in water, forming a pale blue solution which strongly reddens litmus. The aqueous solution gives with chloride of barium a white precipitate, insoluble in hydrochloric acid, and a maroon-red precipitate with yellow prussiate of potash.

Dose.—As an astringent and tonic, $\frac{1}{4}$ grain to 2 grains in pill or solution; as an emetic, 3 to 10 or 15 grains, in solution; as a collyrium, 1 or 2 grains to an ounce of rose water; as an injection, 2 to 5 grains to an ounce of water; as a lotion, 2 to 10 grains to an ounce of water.

Therapeutics.—Sulphate of copper in over-doses acts as an irritant poison, and as such it has been used for criminal purposes. Poisoning may take place either rapidly by a large dose, or more slowly by small and long-continued doses. The symptoms of acute poisoning are divisible into two classes; *first*, those proceeding from the immediate or topical effects of the drug; and, *second*, those arising after its absorption. The primary symptoms are developed within a few minutes of the swallowing of the poison; there is a nauseating, metallic, styptic taste, constriction of the throat and œsophagus, burning and colicky pains in the stomach and bowels, with painful distension of the abdomen and tenesmus; there is usually violent vomiting, and there may be diarrhœa, the vomited matters being of a blue or green colour, and the alvine evacuations sometimes greenish, and at other times darker coloured, with an admixture of blood. There is intolerance of pressure upon the abdomen; the urine is frequently suppressed, and occasionally jaundice has supervened. The secondary symptoms are occasioned by the effects of the poison upon the nervous system; there is general prostration of strength; the pulse is small, weak, frequent, and often irregular; the extremities are cold and trembling, and the face and body are bathed in a cold perspiration; the breathing is hurried and sighing; the patient suffers from intense thirst, headache, and cramps, and gradually sinks into a state of stupor, with or without convulsive attacks. Chronic poisoning by sulphate of copper, or by other preparations of copper, is manifested by the peculiar metallic styptic taste, hot skin, or alternations of heat and cold, thirst, loss of appetite, weariness, gradual emaciation, irritability of stomach, with nausea, and occasionally vomiting of greenish matters, colicky pains in the abdomen which is intolerant of pressure, trembling of the limbs and cramps, diarrhœa, with greenish evacuations, which are occasionally mixed with blood, a small pulse, nervous prostration, a tendency to paralysis, occasionally jaundice, &c. There is said to be also a characteristic purple line round the gums, but in a number of workmen in the metal, examined by the London Clinical Society, a green line was found on the teeth of all but two or three, but there was no blue line on the gums of any of them. Chronic poisoning by copper may occur from the use of copper vessels in the preparation of food; this, however, cannot take place when they are kept clean, but when allowed to stand with acidulous or fatty substances in them, the copper is dissolved, and, being oxidised by the atmosphere, becomes poisonous.

Treatment.—Albumen, as white of egg, or wheaten flour, sugar, encourage vomiting by giving plenty of warm water, or the stomach-pump may be used. Subsequent symptoms to be treated as they arise. Medicinally, sulphate of copper acts as an astringent and tonic; as an emetic; as a styptic; and as an escharotic. It has been recommended in chronic dysentery and diarrhœa, in the diarrhœa of phthisis, and in that attending ulceration of the bowels; it is given in small doses in combination with small quantities of opium. In epilepsy, chorea, hysteria, &c., it has been given in small doses long continued, but in these affections its use is now generally abandoned as its action on the nervous system in medicinal doses is extremely doubtful. As an emetic it acts promptly, and without causing depression of the vital powers ; when given in large doses for this purpose, and not ejected, its removal should be insisted upon by other means of producing vomiting, so as to avoid its irritating effects. As an antidote for phosphorus poisoning (BAMBERGER) as it forms an insoluble black phosphate of copper. Give 3 grains in solution every few minutes until vomiting occurs. As a wash, or in the form of a honey, it is applied to ulcerations of the mouth; as a gargle to ulcerated sore throat ; as an injection, it is used in leucorrhœa and gonorrhœa; as a collyrium, it is applied to purulent ophthalmia, &c. ; as a lotion, to certain skin diseases; as an escharotic, it is applied to exuberant and unhealthy granulations, to indolent ulcers, to remove venereal warts, &c.

Cupri Nitras—Nitrate of Copper—$Cu\ (NO_3)_2,\ 3H_2O$.

Prepared by dissolving copper in diluted nitric acid, and evaporating the solution until crystallisation takes place, on cooling to a temperature not lower than 70° F. (21°·1 C.).

Characters.—Deep blue prismatic crystals, very deliquescent, highly corrosive. With one-third of its weight of water it forms, at a temperature below 70° F. (21°·1 C.), tabular crystals $Cu(NO_3)_2,\ 6H_2O$. With a very little more water it yields a styptic, caustic corrosive fluid. A dilute aqueous solution is only faintly acid to litmus.

Use—Externally, as a caustic in the liquid state, owing to its deliquescence.

Subacetate of Copper of Commerce (Appendix)—Verdigris, $Cu(C_2H_3O_2)_2,\ CuO$. May be obtained by exposing copper plates to the action of the fermenting marc of grapes, or pyroligneous acid, when the salt forms on the surface.

Characters.—In powder, or masses of very small crystals of a bluish-green colour, with a peculiar sour metallic odour, and styptic metallic taste.

Therapeutics.—It is sometimes used externally as an escharotic in powder, or mixed with honey and vinegar, under the name of Linimentum Æruginis; it should be applied with a camel's hair brush.

ZINCUM ($Zn = 65$) is a bluish-white, lustrous, and rather hard metal, commonly of the specific gravity 6·8. It is soluble in hydrochloric and sulphuric acids, and in strong-heated solutions of potash and soda, with the evolution of hydrogen. Metallic zinc may be obtained from the native sulphide or carbonate.

ZINCUM GRANULATUM.—GRANULATED ZINC. *Take of zinc of commerce,* 1 *pound; fuse it in an earthen crucible, heated to a sufficient but not excessive degree in a suitable fire, and pour the fused metal in a thin stream into a vessel containing* 2 *gallons of cold water. Remove the granulated zinc from the water, and dry it.*

Granulated zinc is used in pharmacy.

CALAMINA PRÆPARATA—Prepared Calamine—Lapis Calaminaris Præparata.

Native Carbonate of Lime, calcined in a covered earthen crucible at a moderate temperature, powdered, and freed from gritty particles by elutriation.

Characters.—A pale pinkish-brown powder, without grittiness; almost entirely soluble, with effervescence in acids.

UNGUENTUM CALAMINÆ.—Ointment of calamine. Prepared calamine, 1 ounce; benzoated lard, 5 ounces; mix thoroughly.

Therapeutics.—Calamine is employed externally as a dusting powder, and its ointment in skin diseases to allay irritation.

Zinci Oxidum (ZnO)—Oxide of Zinc—Flowers of Zinc.

PREPARATION.—*Take of carbonate of zinc,* 6 *ounces. Place the carbonate of zinc in a loosely-covered Hessian crucible, and expose it to a dull red heat, until a portion, taken from the centre of the contents of the crucible, and cooled, no longer effervesces when dropped into diluted sulphuric acid. Let the crucible cool, and transfer the product to stoppered bottles.*

Characters.—A soft, nearly white, tasteless and inodorous powder, becoming pale-yellow when heated.

UNGUENTUM ZINCI—OINTMENT OF ZINC—Ointment of

Oxide of Zinc.—*Take of oxide of zinc,* 80 *grains; benzoated lard,* 1 *ounce. Add the oxide of zinc to the benzoated lard, previously melted with a gentle heat, and stir the mixture constantly while it cools.*

Dose.—2 to 10 or more grains, in powder or pill.

Therapeutics.—Oxide of zinc is employed as a tonic, antispasmodic, and astringent. It is slow of action as a tonic, and must, therefore, be long continued. It has been given in epilepsy, chorea, neuralgia, intermittent fever, hooping-cough, and the convulsions of children, in gastrodynia, &c., as a tonic astringent in the colliquative sweats of phthisis. It is sometimes used as an injection in leucorrhœa and in gonorrhœa. As an astringent application, as a powder, or mixed with starch, or better, in the form of ointment, it is applied to sore nipples, excoriations, bed-sores, ophthalmia tarsi, and to a variety of skin diseases, epecially those of an eczematous or impetiginous character, after the acute symptoms have somewhat subsided.

Zinci Chloridum ($ZnCl_2$)—Chloride of Zinc—Butter of Zinc.

PREPARATION.—*Take of granulated zinc,* 16 *ounces; hydrochloric acid,* 44 *fluid ounces; solution of chlorine, a sufficiency; carbonate of zinc,* ½ *ounce, or a sufficiency; distilled water,* 1 *pint. Put the zinc into a porcelain basin, add by degrees the hydrochloric acid previously mixed with the water, and aid the action by gently warming it on a sand-bath until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand-bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in the solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely-stoppered bottles.*

Characters.—Colourless opaque rods or tablets, very deliquescent and caustic; soluble almost entirely in water, alcohol, and ether. The watery solution is precipitated white by sulphide of ammonium and nitrate of silver; but, if first acidulated with hydrochloric acid, it is not affected by sulphuretted hydrogen.

LIQUOR ZINCI CHLORIDI—SOLUTION OF THE CHLORIDE OF ZINC—Sir William Burnett's disinfecting fluid.

PREPARATION.—*Take of granulated zinc,* 1 *pound; hydrochloric* *acid*, 44 *fluid ounces; solution of chlorine, a sufficiency; carbonate of zinc*, ½ *ounce, or a sufficiency; distilled water*, 1 *pint. Mix the hydrochloric acid and water in a porcelain dish, add the zinc, and apply a gentle heat to promote the action until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow the product to cool. Filter it into a bottle, and add solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter the liquid into a porcelain basin, and evaporate until it is reduced to the bulk of* 2 *pints.*

Dose.—½ grain to 2 or 3 grains, well diluted (rarely used).

Therapeutics.—Chloride of zinc, in the form of Sir William Burnett's disinfecting fluid, is sometimes taken by accident. It acts powerfully and fatally, producing the symptoms of a corrosive irritant poison. Antidotes, albumen, magnesia, chalk, carbonate of soda, and emetics. Medicinally, the chloride is but seldom given internally, but has been employed as a nervine tonic. It acts as a deeply-penetrating and powerful escharotic, destroying the part and causing great pain, which lasts for several hours. It may be applied in a thin layer in the form of a paste (made with flour, plaster of Paris, or gypsum), which may be left in contact with the part for several hours, a poultice being applied soon after its application. The neighbouring parts must be well protected. It is applied to ulcerated surfaces, not only with the view of removing morbid tissues, but also to bestow a healthy condition upon the parts immediately beneath the eschar; it is used in cancer, lupus, and a variety of callous and indolent ulcers, morbid growths, &c. It has been employed also to destroy nævi, and to arrest the pain of toothache; for which latter purpose, the cavity of the tooth having been cleared out, a piece of wax, or lint, dipped in a mixture of the chloride and flour or plaster of Paris, is inserted, care being taken to protect the surrounding tissues. It is also used as an injection in gonorrhœa, and as a collyrium in gonorrhœal ophthalmia; in both cases it requires cautious application, of the strength of half-a-grain or a grain to the ounce of water.

Zinci Carbonas ($ZnCO_3(Zn2HO)_2,H_2O$)—Carbonate of Zinc.

Preparation.—*Take of sulphate of zinc*, 10 *ounces; carbonate of sodium*, 10½ *ounces; boiling distilled water, a sufficiency. Dissolve the carbonate of soda with a pint of the water in a capacious porcelain vessel, and pour into it the sulphate of zinc also dissolved in a pint of the water, stirring diligently. Boil for fifteen minutes after effervescence* *has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate 3 pints of boiling distilled water, agitating briskly; let the precipitate again subside, and repeat the processes of affusion of hot distilled water and subsidence, till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat.*

Characters.—White, tasteless, inodorous, insoluble in water; soluble, with effervescence and without residue, in diluted nitric acid.

Therapeutics.—Carbonate of zinc is but little employed, its actions, uses, and doses being the same as the oxide of zinc. Its chief employment is as a desiccant and astringent application to abrasions, ulcerations, and cutaneous diseases.

Zinci Acetas ($Zn(C_2H_3O_2)_2H_2O$)—Acetate of Zinc.

Preparation.—*Take of carbonate of zinc, 2 ounces; acetic acid, 5 fluid ounces, or a sufficiency; distilled water, 6 fluid ounces. Add the carbonate of zinc in successive portions to 3 ounces of the acetic acid previously mixed with the water in a flask; heat gently, add by degrees the remainder of the acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallise. Decant the mother-liquor; evaporate to one-half, and again set it aside for two days to crystallise. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures.*

Characters.—Thin, translucent, and colourless crystalline plates, of a pearly lustre, with a sharp, unpleasant taste, evolving acetic acid when decomposed by sulphuric acid; soluble in water, and the solution precipitated pure white by sulphuretted hydrogen.

Dose.—1 to 5 grains, in pill or solution; as a lotion or injection, 3 to 10 or 20 grains to an ounce of water; or as an ointment.

Therapeutics.—Acetate of zinc acts as an astringent, and as a tonic and antispasmodic. Its chief use is that of a topical astringent; as a lotion to a variety of skin diseases, as a collyrium in ophthalmia, as an injection in gonorrhœa and leucorrhœa, &c. It is rarely used internally, its actions and uses being similar to those of the sulphate.

Zinci Sulphas ($ZnSO_4 7H_2O$)—Sulphate of Zinc—White Vitriol.

Preparation.— *Take of granulated zinc, 16 ounces; sulphuric acid, 12 fluid ounces; distilled water, 4 pints; solution of chlorine, a sufficiency; carbonate of zinc, ½ ounce, or a sufficiency. Pour the sulphuric acid previously mixed with the water on the zinc contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with con-*

stant agitation the solution of chlorine until the fluid acquires a permanent odour of chlorine. Add now with continued agitation the carbonate of zinc until a brown precipitate appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallise. Dry the crystals by exposure to the air on filtering paper; place on porous tiles. More crystals may be obtained by again evaporating the mother-liquor.

Characters.—In colourless, transparent, prismatic crystals, with a strong metallic styptic taste. Its solution in water gives white precipitates with chloride of barium, and sulphide of ammonium.

Dose.—As a tonic and astringent, 1 to 5 or 10 grains, gradually increased, in pill or solution; as an emetic, 10 to 30 grains; as a solution or injection, 1 to 30 grains to an ounce of fluid.

Therapeutics.—Sulphate of zinc in over-doses acts a purely irritant poison, causing violent vomiting with severe abdominal pain, followed by extreme prostration, with or without convulsions. Treatment—encourage vomiting by the administration of warm water. Antidotes—albumen, infusions containing tannin, and treat the symptoms as they arise. Medicinally, it acts as a nervine tonic, astringent, and anti-spasmodic; as a safe, prompt, and energetic stimulating emetic; and externally, as a topical astringent. It was employed in epilepsy, chorea, hysteria, spermatorrhœa, nervous exhaustion from excesses, spasmodic asthma, angina pectoris, chronic diarrhœa, dysentery, and in other chronic passive discharges, &c. As an emetic, it causes but little subsequent depression, and is useful in narcotic poisoning, &c.; as an injection, it is used in gonorrhœa, leucorrhœa, &c. As an astringent lotion, it is applied to certain varieties of ulcers and chronic skin diseases; as a collyrium, in ophthalmia; as a caustic, it is used in the anhydrous state of dried sulphate of zinc, and is applied to broken diseased surfaces, as it does not operate as such where the epithelium is entire.

Zinci Valerianas ($Zn(C_5H_9O_2)_2$)—Valerianate of Zinc.

PREPARATION.—*Take of sulphate of zinc,* 5½ *ounces; valerianate of sodium,* 5 *ounces; distilled water, a sufficiency. Dissolve the sulphate of zinc and the valerianate of sodium, each in* 2 *pints of the water; raise both solutions to near the boiling point; mix them, cool, and skim off the crystals which are produced. Evaporate the mother-liquor at a heat not exceeding* 200° F. (93°·3 C. *till it is reduced to* 4 *ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold distilled water, till the washings give* *but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures.*

Characters.—In brilliant-white pearly, tabular crystals, with a feeble odour of valerianic acid, and a metallic taste; scarcely soluble in cold water or in ether; soluble in hot water and alcohol. Heated to redness in an open crucible, it leaves a residue which, when dissolved in diluted sulphuric acid, yields, with ammonia, a precipitate which entirely dissolves in excess of the reagent, and the resulting solution gives a white precipitate with sulphide of ammonium.

Dose.—$\frac{1}{2}$ grain to 2 or 3 grains, in pill.

Therapeutics.—Valerianate of zinc acts as a nervine tonic and anti-spasmodic; it is employed in those cases in which the other preparations of zinc are used; but it is believed by some to be especially useful in cases complicated with hysteria, and has been highly recommended in the neuralgia of that class. As, however, there is good reason to consider valerianic acid inert, it is difficult to conceive wherein the valerianate should be superior to the other salts of zinc as a nemitonic.

STANNUM (Sn = 118)—Tin—is chiefly obtained fron the native peroxide, which is widely distributed. Tin is a silvery-white or yellowish-white metal, of a hardness between gold and lead, malleable, but imperfectly ductile. Grain tin, procured from stream tin, is the purest form of the metal, and from this is prepared, by fusing it, and pouring it into water, the granulated tin which is placed in the Appendix of the Pharmacopœia. *Pulvis Stanni—Limatura Stanni—Powdered Tin or Tin Filings*—has been used as a vermifuge, its action as such depending probably upon the mechanical irritation of its particles; but it has been suggested that it might arise from the evolution of hydrogen during the solution of the metal in the gastric fluid. *Dose*, 20 to 60 grains, or more, mixed with treacle, several times repeated, preceded and followed by a laxative. *Stanni Chloridum—Chloride of Tin or Butter of Tin* ($SnCl_2$)—has been employed as a tonic and antispasmodic in epilepsy, chorea, &c., and externally as a lotion in certain chronic cutaneous diseases, &c. *Dose*, $\frac{1}{10}$ of a grain to $\frac{1}{2}$ a grain. In large doses it acts as an irritant poison, producing violent convulsions. Solution of chloride of tin is used as a test. See Appendix.

BISMUTHUM (Bi = 210)—Bismuth—in the native state is widely distributed, and is readily extracted from its ores by fusion. It is a reddish-white, tasteless, inodorous metal. It may be obtained in beautiful masses of iridescent cubical crystals. Commercial bismuth may contain several metallic impurities, such as arsenic, iron, copper, &c.

The Pharmacopœia gives the following formula for obtaining pure bismuth :—

Bismuthum Purificatum—Purified Bismuth.

PREPARATION.—*Take of bismuth,* 10 *ounces ; cyanide of potassium,* ½ *ounce; sulphur,* 80 *grains; carbonate of potassium, carbonate of sodium recently ignited, of each a sufficiency. Melt the bismuth in a crucible. Add the cyanide of potassium and sulphur previously mixed. Heat the whole to low redness for about* 15 *minutes, constantly stirring. Remove the crucible from the fire, and let it cool until the fluid has solidified to a crust. Pierce two holes in the crust, and pour the still fluid bismuth into another crucible. Re-melt the partially purified bismuth with about* 5 *per cent. of a mixture of equal parts of the dried carbonate of potassium and sodium, heating to bright redness, and constantly stirring. Remove the crucible from the fire, cool, and pour out the bismuth into suitable moulds.*

The metallic impurities are removed as sulphides in the first operation, the bismuth being unaffected. The second operation removes sulphur.

Characters.—A crystalline metal of a greyish-white colour, with a distinct roseate tinge. Specific gravity, 9·83.

Bismuthi Subnitras ($BiNO_3H_2O$)—Subnitrate of Bismuth—Bismuthum Album—White Bismuth.

PREPARATION.—*Take of purified bismuth, in small pieces,* 2 *ounces; nitric acid,* 4 *fluid ounces; distilled water, a sufficiency. Mix the nitric acid with* 3 *ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to* 2 *fluid ounces, and pour it into* ½ *a gallon of distilled water. When the precipitate which forms has subsided, decant the supernatant liquid, add* ½ *a gallon of distilled water to the precipitate, stir them well together, and after two hours decant off the liquid; collect and drain the precipitate on a calico filter, press it with the hands, and dry it at a temperature not exceeding* 150° F. (65°·5 C.).

Characters.—A heavy white powder in minute crystalline scales, blackened by sulphuretted hydrogen, insoluble in water, but soluble in nitric acid mixed with half its volume of distilled water, forming a solution which, poured into water, gives a white precipitate. It forms with sulphuric acid, diluted with an equal bulk of water, a solution which is blackened by sulphate of iron.

Trochisci Bismuthi—Bismuth Lozenges.

PREPARATION.—*Take of subnitrate of bismuth,* 1440 *grains; carbonate of magnesium,* 4 *ounces; precipitated carbonate of calcium,* 6 *ounces; refined sugar,* 29 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; rose water, a sufficiency. Mix the dry ingredients, then add the mucilage, and form the whole into a proper mass with rose water. Divide the mass into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains* 2 *grains of subnitrate of bismuth.*

Dose.—Of the powder, 2 to 10, 20, or more grains in powder, or suspended in a draught or mixture by mucilage or glycerine, or in electuary. Of the lozenges two to six.

Therapeutics.—Subnitrate of bismuth, known in commerce as Pearl White or Spanish White, was chiefly employed as a cosmetic, till Odier of Geneva pointed out its therapeutical value, in 1786. Since that period it has come into very general use medicinally, both on the Continent and in this country. Poisonous properties have been assigned to it in doses of 120 grains and upwards, and some fatal cases, with symptoms of irritant poisoning, have been attributed to it. But there is the best reason to believe that these accidents were due, not to the subnitrate of bismuth, but, either to the existence of arsenic in it as an impurity (a frequent occurrence, if great care is not taken to have the bismuth from which the subnitrate is prepared thoroughly purified), or to the administration of the ternitrate instead of the subnitrate. The latter accident is the more likely to happen, that the term nitrate has been applied both to the subnitrate and the ternitrate. Doses of the subnitrate, ranging from ½ ounce to 2 ounces per diem, have been frequently administered, and not the slightest inconvenience has resulted. The ternitate, on the other hand, is caustic and irritant.

Internally the subnitrate is used as a sedative and astringent. It is employed to allay irritability of the stomach, and to check vomiting and diarrhœa. For this purpose it is useful in painful dyspepsia with a tendency to diarrhœa ; to allay the irritability resulting from the action of certain poisons in subacute and chronic gastritis, in the chronic gastritis of drunkards, in gastric ulcer, non-malignant and malignant (in the latter as a palliative), &c. When the vomited matters or the gaseous eructations are acid, it is well to combine bismuth with magnesia or an alkaline carbonate. Its action is also frequently aided by small doses of opium. If in dyspepsia the tongue is foul, and the breath smells of rotten eggs, better precede its use by a saline purgative. Bismuth is seldom beneficial in dyspepsia associated with constipation. As an astringent, it is useful during the latter stages of, and period of convalescence from, typhoid fever, in which case it may beneficially be combined with opium ; in mucous diarrhœa, in the premonitory diarrhœa of cholera, in the diarrhœa of phthisis, in chronic dysentery, in diarrhœa following upon weaning, or persisting, after the cutting of a tooth, either alone or with oxide of zinc or pepsine. Externally it is employed as an astringent, desiccant, and sedative, dusted over surfaces in powder, or applied in lotion or ointment.

As an injection, it is employed in leucorrhœa, gonorrhœa, gleet, &c.; as dusting-powder, ointment, or lotion, it is used in chapped nipples, hands, fissures, abrasions, chronic cutaneous disorders, in which cases it is found to absorb moisture, allay smarting and itching, while it protects the parts affected from the air. In irritability of the vagina or cervix it is well applied as a pessary (15 grains in each), with or without atropine or other sedative.

It is exceedingly doubtful whether it exerts any remote sedative effect through the nervous system, or whether it acts merely locally. It most probably exerts a topical action only, protecting the mucous surface of the stomach from the irritation of food, and acting as a slight astringent; this effect is enhanced by its insolubility, which enables it to act slowly and continuously. It ought to be remembered that during the administration of bismuth the stools become black. To be useful in cases of gastric irritation, it is often necessary to give doses of from 10 to 20 grains, three times a day.

Bismuthi Carbonas—Carbonate of Bismuth $(Bi_2O_2CO_3)_2,H_2O$.

PREPARATION.—*Take of purified bismuth, in small pieces,* 2 *ounces; nitric acid,* 4 *fluid ounces; carbonate of ammonium,* 6 *ounces; distilled water, a sufficiency. Mix the nitric acid with* 3 *ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to* 2 *fluid ounces, and add this in small quantities at a time to a cold filtered solution of the carbonate of ammonium in* 2 *pints of distilled water, constantly stirring the mixture as it is formed. Collect the precipitate on a calico filter, and wash it with distilled water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with the hands, and finally dry the product at a temperature not exceeding* 150° F. (65°·5 C).

Characters.—A white powder blackened by sulphuretted hydrogen;

insoluble in water, but soluble with effervescence in nitric acid. When added to sulphuric acid, coloured with sulphate of indigo, the colour of the latter is not discharged. If to nitric acid, mixed with half its volume of distilled water, as much carbonate of bismuth be added as the acid will dissolve, one volume of this solution poured into twenty volumes of water will yield a white precipitate. The nitric acid solution gives no precipitate with diluted sulphuric acid, or with solution of nitrate of silver.

Dose.—5 to 20 grains.

Therapeutics.—The carbonate agrees in action with the subnitrate; but from its greater solubility in the gastric juice, it is found to agree when the subnitrate occasions a sensation of weight, and even prickling, in the stomach. For this reason, and also because it is slightly antacid, it is often to be preferred in cases in which the tongue is red and pointed, or when digestion is painful, and accompanied by belching of acid matters, smelling of sulphuretted hydrogen.

Bismuthi Oxidum—Oxide of Bismuth (Bi_2O_3).

PREPARATION.—*Take of subnitrate of bismuth,* 1 *pound; solution oj soda,* 4 *pints. Mix and boil for five minutes; then having allowed the mixture to cool and the oxide to subside, decant the supernatant liquid, wash the precipitate thoroughly with distilled water, and finally dry the oxide by the heat of a water-bath.*

Characters.—A dull lemon-yellow powder. Heated to incipient redness it is not diminished in weight. It is insoluble in water, but soluble in nitric acid mixed with half its volume of water, and if it be thus dissolved to saturation, the solution mixed with ten or twenty times its volume of water yields a white precipitate. The nitric acid solution gives no precipitate with dilute sulphuric acid, nor with solution of nitrate of silver dropped into it. Solution of chloride of ammonium added to the nitric acid solution gives a white precipitate, and if this be treated with excess of solution of ammonia, then filtered, and the clear filtrate neutralised with hydrochloric acid, it will not become turbid.

Dose.—5 to 15 grains; used in the same way and for the same purposes as the subnitrate. It is a definite compound, usually free from impurities, and may therefore be safely prescribed.

Bismuthi Citras.—Citrate of Bismuth ($BiC_6H_5O_7$).

PREPARATION.—*Take of subnitrate of bismuth,* 5½ *ounces; nitric acid,* 11 *ounces* (*about* 6 *are sufficient*); *citric acid,* 4 *ounces; bicarbonate* *of sodium*, 8 *ounces; distilled water, a sufficiency. Heat the subnitrate with the nitric acid till dissolved; add water, constantly stirring, until the cloudiness produced only slowly disappears. Dissolve the bicarbonate of sodium in distilled water, add the citric acid, boil till all gas is expelled, and add the liquid to the bismuth solution until no further precipitate is produced. Heat to boiling, occasionally stirring, and set aside to cool. Then filter and wash the precipitate till no free nitric acid remains, and dry the product over a water-bath.*

Characters.—A white amorphous powder permanent in the air, odourless and tasteless, insoluble in water and alcohol but soluble in solution of ammonia to a clear or nearly clear liquid.

Dose.—2 to 5 grains.

Now rarely given internally, but used to prepare the liquor bismuthi et ammonii citratis.

Liquor Bismuthi et Ammonii Citratis—Solution of Citrate of Bismuth and Ammonium—Liquor Bismuthi.

PREPARATION.—*Take of citrate of bismuth*, 800 *grains; solution of ammonia and distilled water, of each a sufficiency. Rub the citrate of bismuth to a paste with a little of the water; add the solution of ammonia gradually and with stirring, until the salt is quite dissolved. Dilute with distilled water to form* 1 *pint.*

Characters.—A colourless solution, with a slightly metallic taste Specific gravity, 1·07. Neutral or slightly alkaline to test-paper; mixes with water without change; heated with solution of potash it evolves ammonia, and yields a white precipitate. 2 fluid drachms of the solution, mixed with an ounce of distilled water, and treated with sulphuretted hydrogen in excess, yields a black precipitate, which, collected, washed, and dried, weighs about 7 grains. 1 fluid drachm contains about 3 grains of oxide of bismuth.

Dose.—½ to 1 fluid drachm.

Therapeutics.—This solution contains citrate of bismuth and ammonium, and was introduced into the B.P. as the representative of Schacht's Liquor Bismuth. Schacht's solution is formed by first dissolving bismuth in nitric acid, then throwing down the teroxide of bismuth with ammonia; filtering, washing the filter to get rid of the nitric acid, and afterwards dissolving it in boiling citrate of ammonia. It was represented to be a convenient form for giving bismuth in solution, being soluble in water; but it has the great disadvantage of being irritant in large doses. Besides, it is doubtful if it is so beneficial to give bismuth in a soluble form, because much of the peculiar value of the ordinary forms of bismuth depends upon their insolubility, enabling them to act slowly and persistently.

Bismuthi et Ammonii Citras.—Citrate of Bismuth and Ammonium.

Obtained by evaporating solution of citrate of bismuth and ammonium over a water bath to the consistence of a syrup. Spread the resulting fluid in thin layers on glass or porcelain plates, and dry, at a temperature not exceeding 100° F. (37°·8 C.). Remove the scales, and preserve them in a stoppered bottle.

Characters.—Small, shining, translucent scales, having a slight metallic taste, very soluble in water, yielding ammonia when warmed with solution of a fixed alkali.

Dose.—2 to 5 grains.

Therapeutics.—Employed for the same purpose as the liquor bismuthi et ammonia citratis.

PLUMBUM (Pb = 207)—Lead—The Saturn of alchemists—occurs in a variety of native compounds, but its chief source, for commercial purposes, is the sulphide commonly called *galena*. Pure lead is a bluish-white, brilliant, soft, and flexible metal; it soon tarnishes when exposed to the air, emits a peculiar odour when handled, leaves a dark streak upon paper, and has a specific gravity of 11·4.

In the metallic form lead is inert in the system, but its soluble salts are astringent and sedative, and have, moreover, an action peculiarly their own. The vapour of lead inhaled produces the same effects as the soluble salts when taken by the stomach; but in all cases the metal must assume a soluble condition, either before its administration, or in the gastric fluid, before it can influence the system through the circulation. In large doses the soluble salts of lead act as irritants, and produce the ordinary symptoms, but acute lead poisoning is comparatively rare; in such cases the vomiting is not generally very violent, but the collicky pains are very severe, and there is obstinate constipation. On the other hand, chronic poisoning by lead is a common occurrence. It arises from the gradual accumulation of the poison in the system, either by drinking water in which it is dissolved; or by its absorption through the skin though this can be but to a limited extent; or by its entrance through wounds and abrasions; or in consequence of the dirty habits of those who work amongst it, whereby it is conveyed by the unwashed hands to the food, and therefore transmitted to the stomach; or lastly, by the prolonged medicinal use of one of its salts. *Lead* or *saturnine colic*, or *colica pictonum*, or *painter's colic*, as it is variously called, is the most common manifestation of lead poisoning. In these cases there is an uneasiness, a sense of sinking, and a twisting pain in the neighbourhood of the umbilicus: the abdominal parietes are retracted, rigid, and knotty, and relief is obtained by pressing the abdomen; there is obstinate constipation, loss of appetite, increasing thirst, dryness of the mouth and throat, a sweetish astringent taste, the patient stating that the bitterest substances taste sweet to him, fetid breath, dry and yellowish or dusky skin and conjunctiva, sallow and shrunken countenance, general emaciation, great depression of spirits, and a characteristic blue line along the margins of the gums, which is interrupted wherever a tooth is lost. This blue line is supposed to be due to the formation of sulphide of lead, produced in that situation by the decomposition of particles of food collected between the teeth. It was first observed by Dr Burton. If the poisoning be continued, paralysis usually follows, though in rare instances it precedes, the colicky symptoms. There may be loss of sensation as well as of voluntary motion, and either or both may be accompanied by flitting neuralgic pains in different parts of the body, which is usually attributed by the patient to rheumatism. These, like the abdominal pains, are usually relieved by pressure, but are aggravated by motion. The most common form of lead palsy is the *dropped-hand* or *wrist-drop*, due to the implication of the extensor muscles of the forearm, which, together with the muscles constituting the ball of the thumb, gradually waste away. If the cause be not removed after these symptoms have spread themselves more or less over the trunk and extremities, the brain becomes implicated, being at first sluggish and dull to external impressions, but ultimately taking an abnormal action in the form of delirum, convulsions, or coma, followed by death or amaurosis, neuralgic pains, general convulsions, and chronic nephritis. There are several names applied to the symptoms of lead poisoning. Thus, in addition to those already mentioned, the term *lead arthralgy* or *metallic rheumatism* is applied to the flitting pains; when there is no loss of sensation, it is called *lead* or *saturnine anæsthesia;* and lastly, the affections of the brain are classed under the form *lead* or *saturnine encephalopathy.*

Antidotes.—When the poisoning results from a single over-dose, the indications are to evacuate the stomach by means of an emetic, or by the stomach pump, and this may be preceded by, and certainly should immediately be followed by, a solution of some harmless sulphate, as of magnesia or of soda, with the view of forming the almost inert sulphate of lead, and if in excess, these sulphates, by producing purgation, eliminate the lead compounds from the intestinal canal;

to allay irritation, give opiates and demulcents. Lead colic is usually relieved by a dose of castor oil and a few drops of laudanum; if this fails, croton oil may be given, or alum, in drachm doses. Chronic poisoning is to be combated first by attending to the immediate wants of the patient, and secondly, by eliminating the poison, which can only be effected slowly. Dilute sulphuric acid or sulphate of magnesia may be given to check the action of any of the poison which may still linger in the alimentary canal, whilst factitious sulphur baths may be used to convert that which is near the surface of the body into inert sulphide of lead, whereby the skin is temporarily blackened; in the intervals of the baths the skin should be well rubbed. Iodide of potassium may be given with the view of promoting the discharge of the poison by rendering it more soluble. To prevent lead poisoning, it is necessary to observe cleanliness in the use of leaden or pewter vessels in which food is kept, to avoid the use of water containing the poison, to wash carefully before meals when employed amongst substances containing lead, and also in such cases to take occasional doses of dilute sulphuric acid, or of Epsom salts, if necessary, &c.

Plumbi Oxidum (PbO)—Lythargyrum—Litharge—Oxide of lead.

Protoxide of lead is formed when the temperature of melted lead is raised to a white heat; it then burns with a brilliant flame, and produces fumes of protoxides, which on cooling constitute *Flowers of lead.* When the grey powder formed on the surface of melted lead is exposed to the continued action of heat and air, the *massicot* of commerce is produced, and this, when fused and again solidified by cooling, forms the crystalline mass called litharge.

Characters.—In heavy scales of a pale brick-red colour, completely soluble without effervescence in diluted nitric and acetic acids, either solution, when neutral, giving a copious yellow precipitate with iodide of potassium.

EMPLASTRUM PLUMBI—LEAD PLASTER—Emplastrum Lithargyri—Diachylon Plaster.—*Take of oxide of lead, in fine powder,* 5 *pounds; olive oil,* 10 *pounds; water,* 5 *pounds. Boil all the ingredients together gently by the heat of a steam bath, and keep them simmering for four or five hours, stirring constantly until the product acquires a proper consistence for a plaster, and adding more water during the process if necessary.*

Therapeutics.—Oxide of lead is rarely employed except in the preparation of the plaster; it has been used as a desiccant and astringent dusted over abrasions, ulcers, burns, &c., but it is a somewhat dangerous application. It is never used internally. Lead plaster is employed as the bases of all true plasters. In its preparation the oleic and margaric acids of the oil combine with the oxide of lead to form oleate and margarate of lead, glycerine, which is at the same time set free, being dissolved out by the water. Lead plaster is used as a support to weak parts and as a common strapping.

Plumbi Carbonas $2(PbCO_3,PbO,H_2O)$—Carbonate of Lead—White Lead.

Carbonate of lead is prepared in a variety of ways; chiefly by exposing sheet lead, or bars of lead, to the fumes of acetic or pyroligneous acid, whereby an acetate of lead is formed, which is immediately decomposed by carbonic acid, derived from a mixture of dung and tan in which the vessels containing the acid are placed, and is thus converted into carbonate.

Characters.—A soft heavy white powder, blackened by sulphuretted hydrogen, insoluble in water, soluble with effervescence in diluted acetic acid without leaving any residue, and forming a solution which is precipitated white by sulphuric acid, and yellow by iodide of potassium.

UNGUENTUM PLUMBI CARBONATIS—OINTMENT OF CARBONATE OF LEAD.—*Take of carbonate of lead, in fine powder,* 62 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

Therapeutics.—Carbonate of lead is never used internally; but it is sometimes employed as a desiccant and astringent, and, combined with starch, may be dusted over sores, ulcers, chronic eczema, &c.; but it is apt to be absorbed and produce dangerous results. The ointment is used as a sedative and astringent application to ulcerations, acute skin diseases, excoriations, &c.

Plumbi Acetas $(Pb(C_2H_3O_2)_2 3H_2O)$—Acetate of Lead—Sugar of Lead.

PREPARATION.—*Take of oxide of lead, in fine powder,* 24 *ounces; acetic acid,* 2 *pints, or a sufficiency; distilled water,* 1 *pint. Mix the acetic acid and the water, add the oxide of lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallise, first adding a little acetic acid should the fluid not have a distinctly acid reaction. Drain, and dry the crystals on filtering paper, without heat.*

Characters.—In white crystalline masses, slightly efflorescent, having an acetous odour, and a sweet astringent taste. Its solution in water slightly reddens litmus, gives a yellow precipitate with iodide of potassium, and is precipitated white by sulphuric acid, acetic acid being set free.

PILULA PLUMBI CUM OPIO—PILL OF LEAD AND OPIUM.—*Take of acetate of lead, in fine powder, 36 grains; opium, in fine powder, 6 grains; confection of roses, 6 grains. Beat them into a uniform mass.*

Dose.—Of the acetate, 2 to 3 grains, repeated every two or three hours; or in larger doses, up to 8 or 10 grains, thrice a day; it may be given in pill with confection of roses; if given in mixture, a little acetic acid must be added to keep it in solution, otherwise the carbonic acid present in water would precipitate it. As a lotion or collyrium, from 2 to 10 or 20 or more grains, dissolved in an ounce of water with a little acetic acid to facilitate the solution. It should not be used as a collyrium when there is ulceration of the cornea, as it is apt to cause a permanent opacity. Of the *Pilula Plumbi cum Opio*, one 4-grain pill (containing 3 grains of the acetate, ½ grain of opium, and ½ grain of confection of roses) may be repeated every two or three hours.

SUPPOSITORIA PLUMBI COMPOSITA—COMPOUND SUPPOSITORIES OF LEAD.

PREPARATION.—*Take of acetate of lead, 36 grains; opium, in powder, 12 grains; oil of theobroma, 132 grains. Rub the acetate of lead and opium with 42 grains of the oil of theobroma in a slightly warmed mortar, and add them to the remainder of the oil of theobroma previously melted at a low temperature. Mix the whole thoroughly, and pour the mixture while it is fluid into suitable moulds of the capacity of 15 grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

Therapeutics.—An astringent, antispasmodic, sedative anodyne, and narcotic application, useful in piles, in inflamed and irritable states of the rectum generally. One to be used at intervals, depending on the effects required to be produced. Each suppository contains 1 grain of opium and 3 grains of the acetate of lead.

UNGUENTUM PLUMBI ACETATIS—OINTMENT OF ACETATE OF LEAD.—*Take of acetate of lead, in fine powder, 12 grains; benzoated lard, 1 ounce. Mix thoroughly.*

Therapeutics.—Acetate of lead in over-doses may act as an irritant poison, the treatment for which has already been mentioned in the previous general remarks upon the soluble salts of lead. Medicinally, it acts as an astringent and sedative; it is useful in choleraic diarrhœa, and in chronic diarrhœa and dysentery; in both active and passive hæmorrhages from the lungs, stomach, bowels, urinary organs, and uterus; in menorrhagia; in chronic bronchitis with profuse secretion of mucus; in excessive salivation produced by mercury; in ulceration of the stomach, &c. Externally, as a lotion or ointment in a variety of inflammatory skin diseases, superficial inflammations, erysipelas, sprains, abrasions, &c.; as a collyrium, in ophthalmia, and in the state of impalpable powder it is applied to granular ophthalmia; as an injection, in gonorrhœa, gleet, leucorrhœa, &c.

Liquor Plumbi Subacetatis—Solution of Subacetate of Lead—Liquor Plumbi Diacetatis—Gourlard's Extract—Subacetate of Lead ($Pb_2O(C_2H_3O_2)_2$) dissolved in water.

PREPARATION.—*Take of acetate of lead,* 5 *ounces; oxide of lead, in powder,* 3½ *ounces; distilled water,* 1 *pint, or a sufficiency. Boil the acetate of lead and the oxide of lead in the water for half an hour, constantly stirring; then filter, and when the liquid is cold, add to it more distilled water, until the product measures* 20 *fluid ounces. Keep the clear solution in stoppered bottles.*

Characters.—A dense, clear, colourless liquid, with alkaline reaction and sweet astringent taste, becoming turbid by exposure to the air; and forming with mucilage of gum arabic an opaque white jelly. Sulphuric acid in excess gives a white precipitate, acetic acid being set free. Specific gravity 1·275.

Glycerinum Plumbi Subacetatis—Glycerine of subacetate of Lead.—*Acetate of lead,* 5 *ounces; oxide of lead, in powder,* 3½ *ounces; glycerine,* 1 *pint; distilled water,* 12 *fluid ounces. Mix together and boil for a quarter of an hour; then filter and evaporate until the water is dissipated.*

UNGUENTUM GLYCERINI PLUMBI SUBACETATIS—OINTMENT OF GLYCERINE OF SUBACETATE OF LEAD.—*Take of glycerine of subacetate of lead,* 4½ *ounces; soft paraffin,* 18 *ounces; hard paraffin,* 6 *ounces. Melt the hard and soft paraffin together; then add the glycerine of subacetate of lead, and stir until the mixture has cooled.*

LIQUOR PLUMBI SUBACETATIS DILUTUS—DILUTE SOLUTION OF SUBACETATE OF LEAD—GOULARD WATER.—*Take of solution of subacetate of lead, rectified spirit, of each* 2 *fluid drachms; distilled water,* 19½ *fluid ounces. Mix, and filter through paper. Keep the clear solution in a stoppered bottle.*

Therapeutics.—Solution of subacetate of lead is not used internally; in large doses it is poisonous. Externally, the dilute solution and ointment are useful as a mild astringent and sedative application to many irritable and itching skin diseases, superficial inflammations, erysipelas, bruises, sprains, abrasions, burns, chilblains, &c.; as a collyrium, except when there is ulceration of the cornea; as an injection in leucorrhœa, &c.; as a wash and gargle in mercurial salivation and syphilitic sore throat, &c.

PLUMBI NITRAS—Nitrate of Lead ($Pb(NO_3)_2$).—May be prepared by saturating dilute nitric acid with litharge with the aid of a gentle heat, filtering and crystallising.

Characters.—In colourless, octahedral crystals, which are nearly opaque, permanent in the air, of a sweetish astringent taste, soluble in water and in alcohol.

Therapeutics.—The nitrate is rarely used internally, and acts like the acetate, but is more irritant, in doses of ½ grain to 1 grain. In solution, it has been used as an application to chapped nipples, &c. As a deodoriser and so-called disinfectant, it is used because it decomposes sulphuretted hydrogen. *Ledoyen's Disinfecting Fluid* is a solution of this salt, in the proportion of a drachm to an ounce. *Fused Nitrate of Lead* may be used as a caustic. It is used in the preparation of iodide of lead.

PLUMBI IODIDUM—and its plaster and ointment, which are now official, are given under Iodine, at pages 25, 26.

STIBIUM (Sb = 122)—Antimonium.—Antimony is chiefly obtained from the native sulphide, the Stibium of the ancients. It is a brilliant, bluish-white, crystalline, brittle metal, having a specific gravity of 6·7. The metal itself is not used medicinally, the officinal preparations being obtained from the sulphuret.

Antimonium Nigrum Purificatum—Purified Black Antimony.—Native sulphide of antimony, Sb_2S_3, purified from siliceous matter by fusion, reduced to fine powder, and, if necessary, treated with solution of ammonia, which dissolves out any traces of arsenium. Not used as a drug, but employed in the preparation of Antimonium Sulphuratum and Liquor Antimonii Chloridi.

Characters.—A greyish-black crystalline powder. It dissolves almost entirely in boiling hydrochloric acid evolving sulphuretted hydrogen, and the solution affords a white precipitate when thrown into water.

Antimonium Sulphuratum—Sulphurated Antimony.—A mixture containing sulphide and oxide of Antimony, Sb_2S_5 and Sb_2O_3.

Preparation.—*Take of purified black antimony,* 10 *ounces; sublimed sulphur,* 10 *ounces; solution of soda,* 4½ *pints; diluted sulphuric acid and distilled water, of each a sufficiency. Mix the antimony with the sublimed sulphur and the solution of soda, and boil for two hours with frequent stirring, adding distilled water occasionally to maintain the same volume. While still hot add* 9 *pints of boiling* *distilled water. Strain the liquor through calico, and before it cools add to it by degrees the diluted sulphuric acid till the latter is in slight excess. Collect the precipitate on a calico filter, wash with distilled water till the washings no longer precipitate with chloride of barium, and dry at a temperature not exceeding* 212° F. (100° C.).

Characters.—An orange-red powder, readily dissolved by caustic soda, also by hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of sulphur. Boiled in water with acid tartrate of potash, the resulting solution is precipitated orange-red with sulphuretted hydrogen.

Dose.—1 to 4 or 5 grains, but it is seldom prescribed otherwise than in the compound calomel or Plummer's pill. In larger doses, up to 10 or 20 grains, it is emetic.

Therapeutics.—Sulphurated antimony is said to act as an alterative, diaphoretic, and emetic, but it is so uncertain in its operation, on account of its insolubility, that it is rarely employed alone. In the form of Plummer's pill it is used with advantage as an alterative in cutaneous diseases, especially those of syphilitic origin, in chronic rheumatism, &c.

Antimonii Chloridi Liquor—Solution of Chloride of Antimony—Chloride of Antimony, $SbCl_3$, dissolved in hydrochloric acid.

PREPARATION.—*Take of purified black antimony,* 1 *pound; hydrochloric acid,* 4 *pints. Place the black antimony in a porcelain vessel; pour upon it the hydrochloric acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of* 2 *pints, and preserve it in a stoppered bottle.*

Characters.—A heavy liquid, usually of a yellowish-red colour. A little of it dropped into water gives a white precipitate, and the filtered solution lets fall a copious deposit on the addition of nitrate of silver. If the white precipitate formed by water be treated with sulphuretted hydrogen, it becomes orange-coloured.

Therapeutics.—Terchloride of antimony was formerly employed in the solid form of *butter of antimony*, but now it is rarely used otherwise than in solution. It acts as a powerful caustic, and as such is applied to the bites of rabid animals, poisoned wounds, cancerous, phagedenic, and sloughing ulcerations, &c. It is also found useful in cases of persistent acne of the face, frequently associated with uterine derangement. Its action in this case is easily limited by brushing the part with carbonate of soda immediately after the application of the chloride. It is sometimes employed with advantage in hypertrophied conditions of the skin, acting as a discutient upon cutaneous tubercles. When swallowed, it acts as a powerful corrosive poison, the symptoms and treatment being similar to those of poisoning by hydrochloric acid.

Antimonii Oxidum (Sb_2O_3)—Oxide of Antimony—Flowers of Antimony.

PREPARATION.—*Take solution of chloride of antimony,* 16 *fluid ounces; carbonate of sodium,* 6 *ounces; water,* 2 *gallons; distilled water, a sufficiency. Pour the antimonial solution into the water, mix thoroughly, let the precipitate settle, and remove the supernatant liquid by a siphon; add* 1 *gallon of distilled water, agitate well, let the precipitate subside; again withdraw the fluid and repeat the processes of affusion of distilled water, agitation, and subsidence. Add now the carbonate of sodium previously dissolved in* 2 *pints of distilled water, leave them in contact for half an hour, stirring frequently, collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a heat not exceeding* 212° F. (100° C.).

Characters.—A greyish-white powder fusible at a low red heat, insoluble in water, but readily dissolved by hydrochloric acid. The solution, dropped into distilled water, gives a white deposit, at once changed to orange by sulphuretted hydrogen.

PULVIS ANTIMONIALIS—ANTIMONIAL POWDER.—*Take of oxide of antimony,* 1 *ounce; phosphate of calcium,* 2 *ounces. Mix them thoroughly.*

This is a white, tasteless, inodorous powder, and is the official representative of the empirical and patented *James's fever powder*, which has for so many years been held in high estimation. Opinions differ as to the constitution of James's powder, but most of the samples analysed appeared to consist of a small quantity of oxide of antimony, with a trace of antimonite of lime, the bulk of the powder being made up of inert antimonious acid and phosphate of lime. The official powder consists of one portion of oxide of antimony to two of the precipitated phosphate of calcium, and has not, in consequence of the phosphate being prepared by precipitation, the gritty taste of the old antimonial powder.

Dose.—Of the oxide, 3 to 10 grains, in powder or pill; of antimonial powder, 2 to 5 or 10 or more grains; but the larger doses, unless approached by degrees, may cause vomiting; it may be given in powder or pills. The previous antimonial powders, from the method of their preparation, were of very uncertain strength, and were given in doses which it would be dangerous to adopt with the present uniform powder.

Therapeutics.—Oxide of antimony and antimoniacal powder, in small doses of 2 or 3 grains act as alteratives; in somewhat larger doses, as diaphoretics; and in still larger doses, as emetics and irritants. Their action and uses resemble those of tartar emetic, but, being less soluble, they are also less energetic. As alteratives they are useful in the treatment of chronic skin diseases; and as diaphoretics they are employed in such febrile and inflammatory cases as are relieved by sweating.

Antimonium Tartaratum $(KSbOC_4H_4O_6)_2H_2O$ — Tartarated Antimony — Antimonii Potassio-Tartras — Antimonii et Potassæ Tartras—Tartrate of Antimony and Potash—Tartar Emetic.

Preparation.—*Take of oxide of antimony,* 5 *ounces; acid tartrate of potassium in fine powder,* 6 *ounces; distilled water,* 2 *pints. Mix the oxide of antimony and acid tartrate of potash with sufficient distilled water to form a paste, and set aside for twenty-four hours. Then add the remainder of the water, and boil for a quarter of an hour, stirring frequently. Filter and set aside the clear filtrate to crystallise. Pour off the mother-liquid, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air.*

Characters.—In colourless transparent crystals exhibiting triangular facets, soluble in water, and less so in proof-spirit. It decrepitates and blackens upon the application of heat. Its solution in water gives with hydrochloric acid a white precipitate, soluble in excess, and which is not formed if tartaric acid be previously added. 29 grains dissolve slowly but without residue, in a fluid ounce of distilled water at 60° F. (15°·5 C.), and the solution gives with sulphuretted hydrogen an orange precipitate, which, when washed and dried at 212° F. (100° C.), weighs 15·1 grains.

VINUM ANTIMONIALE—Antimonial Wine.—*Take of tartarated antimony,* 40 *grains; sherry,* 1 *pint. Dissolve.* Strength 2 grains to the ounce.

UNGUENTUM ANTIMONII TARTARATI—Ointment of Tartarated Antimony.—*Take of tartarated antimony, in fine powder,* ¼ *ounce; simple ointment,* 1 *ounce. Mix thoroughly.*

Dose.—Of the salt, as a diaphoretic or expectorant, from $\frac{1}{12}$ to $\frac{1}{6}$ of a grain; as a nauseant and sudorific, $\frac{1}{4}$ to $\frac{1}{2}$ grain; as an emetic, 1 to 3 grains; as a sedative or contra-stimulant, $\frac{1}{2}$ grain to 2 or 3 grains, frequently repeated, and cautiously administered, so as not to produce vomiting. Of the wine as a diaphoretic or expectorant, 10 to 30 minims; as a nauseant, 1 to 2 drachms; as an emetic, 2 drachms, repeated at short intervals, or in a full dose of $\frac{1}{2}$ ounce; but the wine is most useful in small doses. Of the ointment, 30 grains may be rubbed in and be repeated until an eruption appears, and the action may be kept up by anointing fresh parts as the eruption dies away. Tartar emetic may be applied for the same purpose in solution. As an emetic, its action is promoted by the addition of ipecacuanha, and its diaphoretic effects by combination with other diaphoretics, such as nitrate of potash. Opium may be combined with tartar emetic where it is desirable to combat its irritant properties, in cases in which opium is admissible.

Therapeutics.—Tartar emetic, even in small medicinal doses, has produced alarming and occasionally fatal effects in children. Adults, on the other hand, have been known to take large quantities with impunity, probably in consequence of the poison being removed by vomiting before it had produced either powerfully irritant or sedative effects. In over-doses, however, tartar emetic acts chiefly as an irritant, but also somewhat as a corrosive poison. The quantity necessary to a fatal result depends chiefly upon the vomiting and purging that ensue: an ounce has been taken followed by recovery; but, on the other hand, a drachm has proved fatal, and 4 grains have given rise to alarming symptoms, even when free vomiting and purging followed. The symptoms observable in acute poisoning by tartar emetic, though variable, are usually the nauseous metallic taste of the poison, violent vomiting, with burning pain and constriction of the throat and œsophagus, difficulty of swallowing, and great thirst; pain in the stomach and bowels, and generally free purging; cramps in the limbs; cold clammy state of the skin, sometimes with a varioloid eruption; flushed, congested, or dusky countenance, husky voice, or complete inarticulation, extreme muscular depression, with small, weak, and frequent, or imperceptible pulse, delirium, death. There is, however, when prompt treatment is applied, a strong tendency to recover in acute poisoning by tartar emetic. Tartar emetic has frequently been employed for criminal purposes in small doses long continued, the intention being to induce the belief that the victim suffers from typhoid fever: the symptoms of chronic poisoning are chiefly nausea, vomiting, purging, small and frequent pulse, great muscular depression and weariness, a cold and clammy state of the surface, and general emaciation and exhaustion. *Antidote*, tannic acid or vegetable infusions containing it or the moist peroxide of iron.

Medicinally, tartar emetic is employed as a diaphoretic, exceptorant, nauseant, sedative of the vascular system, contra-stimulant, emetic, counter-irritant, &c. It is contra-indicated in all cases of genuine debility, and as an emetic is unsuited to cases which will not bear depression, as in narcotic poisoning, or in cases of heart disease. It operates as an emetic, when given in sufficient doses, by whatever channel it is introduced into the system, whether by the stomach or rectum, or injected into a vein; and consequently it is sometimes administered by one of the latter methods to produce vomiting, and thereby to discharge impacted substances from the œsophagus, it induces vomiting chiefly by an action on the medulla, and not by mechanical irritation of the stomach. When given in quantities insufficient to cause vomiting, its administration is followed by a distinct diminution both in the force and frequency of the pulse, and likewise in the number of respirations; subsequently, it increases the activity of one or other of the secreting organs, acting either as a diaphoretic, diuretic, expectorant, or cholagogue. Tartar emetic has been given in continued, remittent, and intermittent fevers; in acute inflammatory attacks, such as pneumonia, in which it has been recommended in large doses, bronchitis, and pleurisy, but it should only be given in sthenic cases; in croup and laryngitis; in acute rheumatism; in inflammation and dropsies of the joints, in meningitis, in acute and chronic hydrocephalus, in insanity, in delirium tremens, in which it is beneficially combined with an opiate; to check certain internal hemorrhages by subduing the circulation; in gonorrhœa, orchitis, bubo, &c. It was formerly used to produce muscular prostration in strangulated hernia and dislocations, but is now superseded by chloroform; also to promote the dilatation of the os uteri in tedious labours, &c. Externally, it is employed as a counter-irritant, causing a pustular, varioloid eruption, which often causes great pain, and is sometimes troublesome to heal. It is used as a derivative in chronic diseases of the chest and throat, chronic affections of the joints, neuralgia, &c., &c.

ARSENIUM (As=75)—Arsenic—occurs native in the form of *oxide* and *sulphide*, but more commonly it is in combination with other metals in the form of arseniurets, as of copper, cobalt, nickel, and iron. Metallic arsenic is of crystalline texture, very brittle, and of a steel-grey colour; it tarnishes when exposed to the air, falling into a greyish-black powder, volatilises when heated, and sublimes in closed vessels at a temperature below its fusing-point, giving off colourless fumes which have the odour of garlic. At a higher temperature it ignites, burns with a blue flame, and forms arsenious acid. It has a specific gravity of 5·75. It forms acids with oxygen.

Acidum Arseniosum (As_2O_3)—Arsenious Acid—Arsenicum Album—White Arsenic—Anhydrous Arsenious Acid.

Commercial arsenious acid, which is obtained by roasting the arseniurets in a reverberatory furnace, is purified for medicinal purposes by sublimation.

Take of arsenious acid of commerce, 100 *grains. Introduce the commercial arsenious acid into a thin porcelain capsule of a circular shape; and, having covered this as accurately as possible with a glass flask filled with cold water, apply the heat of a gas lamp. Sublimed arsenious acid will be found adhering to the bottom of the flask. Should a larger quantity be required, the commercial arsenious acid should be sublimed by the heat of a gas lamp or of burning charcoal, from a small Florence flask, the neck of which is passed into a second flask of larger size; and the flask containing the commercial arsenious acid should be furnished with a hood of sheet iron to counteract the cooling influence of the atmosphere. These processes should be conducted in the vicinity of a flue with a good draught, so as to carry off any vapours of arsenious acid which may escape.*

Characters.—Occurs as a heavy white powder, or in sublimed masses, which usually present a stratified appearance, caused by the existence of separate layers differing from each other in degrees of opacity. When slowly sublimed in a glass tube, it forms minute, brilliant, and transparent octahedral crystals. It is sparingly soluble in water, and its solution gives with ammonio-nitrate of silver a canary-yellow precipitate insoluble in water, but readily dissolved by ammonia and by nitric acid. Sprinkled on a red-hot coal, it emits an alliaceous odour. It is entirely volatilised at a temperature not exceeding 400° F. (204°·4 C.).

LIQUOR ARSENICALIS — ARSENICAL SOLUTION — LIQUOR POTASSÆ ARSENITIS—FOWLER'S SOLUTION—TASTELESS AGUE DROP. —*Take of arsenious acid, carbonate of potassium, of each* 87 *grains; compound tincture of lavender,* 5 *fluid drachms; distilled water, a sufficiency. Place the arsenious acid and the carbonate of potassium in a flask with* 10 *ounces of the water, and apply heat until a clear solution* *is obtained. Allow this to cool. Then add the compound tincture of lavender, and as much distilled water as will make the bulk 1 pint.*

Characters.—A reddish liquid, alkaline to test paper, and having the odour of lavender; sp. gr. 1·010. After being acidulated with hydrochloric acid it gives with sulphuretted hydrogen a yellow precipitate, which is brighter when the arsenical solution has been previously diluted. 442 grains by weight (1 fluid ounce) boiled for five minutes with 10 grains of bicarbonate of sodium and when cold diluted with 6 fluid ounces of water to which a little mucilage of starch has been added, does not give with the volumetric solution of iodine a permanent blue colour until 875 grain-measures have been added; corresponding to 1 per cent. of arsenious acid, or to rather more than 4 grains ($4\frac{1}{3}$) in 1 fluid ounce.

Dose.—2 to 8 minims.

LIQUOR ARSENICI HYDROCHLORICUS—Hydrochloric solution of Arsenic—De Valengin's Solution.

Take of arsenious acid, in powder, 87 *grains; hydrochloric acid,* 2 *fluid drachms; distilled water, a sufficiency. Boil the arsenious acid with the hydrochloric acid and* 4 *ounces of the water until it is dissolved, then add distilled water to make the bulk up to* 1 *pint.*

Characters.—A colourless liquid, having an acid reaction. Specific gravity 1·010, corresponding to 1 per cent. of arsenious acid.

This preparation is of the same strength as the Liquor Arsenicalis and nearly three times the strength of the original De Valengin's solution. Its action is similar to the Liquor Arsenicalis, but some practitioners believe it superior to the latter. De Valengin's solution is reputed to be less irritating than Fowler's solution, and consequently less apt to have its therapeutical uses interfered with by gastric derangement. This, however, is only true of the original solution, and not of the official one, which is of the same strength as the Liquor Arsenicalis, viz., 4 grains to the ounce.

Dose.—Of arsenious acid, $\frac{1}{20}$ to $\frac{1}{8}$ of a grain, in pill or solution; of Liquor Arsenicalis, and of Liquor Arsenici Hydrochloricus, 2 to 5 or cautiously up to 10 minims. It is better to give the doses after meals, to avoid the risk of irritating the stomach.

Therapeutics.—Arsenious acid has so commonly been employed for criminal purposes, that an Act of Parliament was passed to prevent the sale of it unless coloured either by soot or indigo; and although a certain immunity from its effects is known to be obtained by the peasants in Styria, still we can regard it only as a powerful irritant poison when taken in over-doses. It is difficult to state the smallest dose that may prove fatal, as so much depends upon the condition of the stomach, as to food, at the time it is swallowed, and the vomiting which follows. Even medicinal doses sometimes give rise to alarming symptoms, and 2 grains in solution would possibly prove fatal; but, on the other hand, half an ounce has been taken, followed by free vomiting, without producing serious results. The poisonous effects of arsenic may also ensue upon its external application; several fatal cases have occurred from the employment of arsenious acid as an escharotic, even when used in very small quantity; also from its inhalation, from its use in the arts, from wall-papers, dresses, or sweets coloured with it. In acute poisoning by arsenic, the symptoms—which may supervene within a few minutes of the swallowing of the poison, or not until half an hour or an hour afterwards, or, though more rarely, not until several hours have elapsed—usually commence with a feeling of nausea, depression, and faintness, followed by severe burning pain in the stomach, which is increased by pressure; this is followed by severe vomiting and purging, the vomited matters becoming dark, grumous, and often bloody, or yellowish or greenish from the admixture of bile, whilst the alvine evacuations frequently contain much blood and mucus. The urine is often scanty, high coloured, and mixed with blood; its passage is attended with great pain, and the patient suffers more or less from uncontrollable priapism. There is a feeling of heat and constriction in the fauces and gullet; intense thirst; cramps in the legs; the vomiting becomes more violent; the abdomen becomes swollen and hard: there is severe pain in the bowels, with tenesmus and continued purging; the pulse is thready and irregular; the surface of the body may be either hot, or cold and clammy; the breathing is laboured, and as much as possible thoracic, so as to avoid movement of the abdomen, and pressure upon the inflamed stomach and bowels; extreme prostration and faintness; more or less of paralysis, with alternations of spasmodic movements, delirium, distressing hiccough, death. There are some very rare cases in which no symptoms of gastro-enteric inflammation are present; there is no pain in those regions, and the patient appears to sink from extreme nervous depression, death being ushered in either by syncope, coma, or convulsions, with intervals of delirium. Death may take place at any time from two hours to several days after swallowing the poison. *Treatment.*—If vomiting is not caused freely by the poison, an emetic, or stomach-pump, then administer moist peroxide of iron, or solution of dialysed iron, which does equally well. The former is best prepared by precipitation, by adding magnesia to a solution of the persulphate or chloride of iron, and give it freely. It forms an insoluble compound with arsenious acid; and follow it with a brisk purgative. In slow or chronic arsenical poisoning, or when unduly continued as a medicine, there is usually considerable irritation of the mucous membrane of the alimentary canal, pain in the stomach and bowels, nausea or vomiting, and free purging, accompanied by tormina and tenesmus; the tongue is furred and dry; there is a burning sensation and a feeling of constriction in the fauces and gullet, with intense thirst and occasional spitting of blood; the pulse becomes wiry and rapid; there is gradual emaciation, the eyes become red and suffused, and there is intolerance of light; the eyelids are puffy; and the face, and afterwards the limbs become œdematous; there is frontal headache, nervous tremors or spasms, and a cutaneous vesicular eruption, termed *eczema arsenicale;* and, finally, death may be preceded by convulsions, or more rarely by coma, but usually there is a keen perception of suffering to the last. Arsenic exerts an antiseptic action on the tissues of persons who have died from its poisonous effects.

Medicinally, arsenious acid, administered internally, acts as a stomachic, a nervine tonic, antiperiodic, and alterative; and applied externally, as a stimulant, irritant, and escharotic. As a *tonic*, it is specially useful in nervous diseases of a spasmodic character, such as chorea (for which it is the best remedy known), spasmodic asthma, paralysis agitans, &c.; also in atonic dyspepsia, in chronic diarrhœa, where the bowels tend to move immediately after meals, and the stools consists of half-digested food. As an *antiperiodic*, it is second only to quinine, and is employed in the treatment of intermittent fever and various recurrent neuralgias, as tic-douloureux, hemicrania, &c. It is especially useful in chronic malarial poisoning given along with quinine. As an *alterative*, it is administered in various diseases of the skin, but it is most useful in the scaly class, as in the various species of psoriasis. It is often beneficial also in chronic eczema, impetigo, pompholyx, pemphygus; but it should only be administered in chronic skin eruptions, as it is apt to aggravate acute cases by its stimulant action, which is principally exerted on the superficial layer of the skin. It is likewise recommended in the treatment of chronic rheumatism. In rheumatoid arthritis, for which it was first proposed by Haygarth. In certain vesicular and ulcerative diseases of the mouth and throat, as in cancrum oris, lupis exedens, &c., it is found very beneficial.

Arsenic requires to be administered in carefully increased doses, and to be stopped or at once diminished, if the conjunctivæ become œdematous or red, or if the bowels become loose. A silvery whiteness of the tongue, originally pointed out by Dr Begbie, is one of the first signs that the system has been got fairly under the influence of arsenic. Externally, arsenious acid acts as a stimulant to the skin, and is a not infrequent constituent of various cosmetics.

It is applied as an escharotic in the destruction of lupus exedens, cancerous masses, parts bitten by poisonous animals, onychia maligna, &c. Its use is not unattended by danger from absorption of the poison, but the risk is made much less if a strong paste is used in preference to a weak one. It acts by setting up destructive inflammation in the part, and, if the irritation produced is sufficiently intense, absorption does not take place. Solutions of arsenic in glycerine, gr. i.-ii in ℥j., form very effective antiparasitic applications in the treatment of ringworm both of the head and of the body, and also in other epizoic skin diseases.

Sodii Arsenias, $Na_2HAsO_4 12H_2O$ and $Na_2HAsO_4,7H_2O$—Arseniate of Sodium.

Preparation.—*Take of arsenious acid,* 10 *ounces ; nitrate of sodium,* 8½ *ounces ; dried carbonate of sodium,* 5½ *ounces ; boiling distilled water,* 35 *fluid ounces. Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat, till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and, as soon as it has solidified, and while it is still warm, put it into the boiling water, stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and, having dried them rapidly on filtering paper, enclose them in stoppered bottles.*

Characters.—In colourless transparent prisms, soluble in water ; the solution is alkaline, giving white precipitates with chloride of barium, chloride of calcium, and sulphate of zinc, and a brick-red precipitate with nitrate of silver, all of which are soluble in nitric acid.

LIQUOR SODII ARSENIATIS—Solution of Arseniate of Sodium.—*Take of arseniate of soda (rendered anhydrous by a heat not exceeding* 300° F. (148°·9 C.), 9 *grains; distilled water,* 2 *fluid ounces. Dissolve.* The salt crystallises with a variable quantity of water ; hence, for uniformity of strength, it is necessary to drive off all the water before preparing the solution. The strength is 1 in 100.

Dose.—Of the crystallised salt, from $\frac{1}{16}$ to $\frac{1}{8}$ of an grain; of the anhydrous salt, $\frac{1}{25}$ to $\frac{1}{12}$ of a grain, in pill or in solution; but it is rarely used otherwise than as the official solution, of which the dose is 5 to 10 minims.

Therapeutics.—Arseniate of sodium is much used on the Continent. It may be employed instead of arsenious acid or *liquor arsenicalis*, for it is often found that one preparation of arsenic will cause irritation when another will be readily borne, and the arseniate of sodium is said to be less irritating than the arseniate of potassium.

Ferri Arsenias—Arseniate of Iron—Arseniates of Iron ($Fe_3As_2O_8$), with some oxide.

PREPARATION.—*Take of sulphate of iron,* 20¾ *ounces; arseniate of sodium dried at* 300° F. (148°·9 C.) 15¾ *ounces; bicarbonate of sodium* 4½ *ounces; boiling distilled water, a sufficiency. Dissolve the arseniate and bicarbonate of sodium in* 5 *pints, and the sulphate of iron in* 6 *pints of the water, mix the two solutions, collect the precipitate which forms on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks in a warm-air chamber whose temperature shall not exceed* 100° F. (37°·8 C.).

Characters.—A tasteless amorphous powder of a green colour, insoluble in water, but readily dissolved by hydrochloric acid. This solution gives a copious light-blue precipitate with the yellow prussiate of potash, and a still more abundant one of a deeper colour with the red prussiate of potash. A small quantity boiled with an excess of caustic soda, and filtered, gives, when exactly neutralised by nitric acid, a brick-red precipitate on the addition of solution of nitrate of silver.

Dose.—From $\frac{1}{16}$ to $\frac{1}{2}$ of a grain, in pill.

Therapeutics.—Arseniate of iron acts as a tonic and alterative, and is employed in cases in which the double effects of iron and arsenic are desired, as in certain obstinate chronic skin diseases occurring in anæmic subjects; but the amount of iron the medicinal dose contains is probably much too small to be of therapeutical value, it is therefore simply another form of prescribing arsenic, and might be left out of the B. P. with no loss.

Arsenii Iodidum—Iodide of Arsenium (AsI_3)—Iodide of Arsenic; Arsenious Iodide—obtained by the direct combination of iodine and metallic arsenium, or by evaporating to dryness an aqueous mixture of arsenious and hydriodic acid.

Characters.—Small orange-red crystals soluble in water and rectified spirit; its aqueous solution gives a yellow precipitate with sulphuretted hydrogen. Heated in a test tube it almost entirely volatilises, violet vapours of iodine being set free.

Dose.—$\frac{1}{30}$ of a grain.

Use.—It is employed in the preparation of liquor arsenii et hydrargyri iodidi and is sometimes administered internally in chronic skin affections.

LIQUOR ARSENII ET HYDRARGYRI IODIDI—Solution of the Iodides of Arsenium and of Mercury (Donovan's Solution).

PREPARATION.—*Take of iodide of arsenium, red iodide of mercury, of each* 45 *grains; distilled water, a sufficiency. Triturate the iodides with about* $1\frac{1}{2}$ *ounce of distilled water until nearly all is dissolved. Pass through a filter, and wash the latter with sufficient water to produce* 10 *fluid ounces.*

Characters.—A clear pale yellow liquid with a metallic flavour, sp. gr. 1·016. One fluid ounce contains, about $\frac{1}{100}$ of a molecular weight in grains (about 1 per cent. by weight) of Arsenious Iodide (AsI_3), and of Mercuric Iodide (HgI_2).

Dose.—10 to 30 minims.

Therapeutics.—It may be given in doses of 10 to 20 or 30 minims, sufficiently diluted, as an alterative in chronic cutaneous diseases, especially of the squamous kind, and those of syphilitic origin, and also as a lotion in similar cases.

HYDRARGYRUM ($Hg = 200$)—Mercury—Quicksilver.

Characters and Tests.—A metal, fluid at common temperatures, brilliantly lustrous, and easily divisible into spherical globules. Volatilises at a heat below that of visible redness, leaving no residue.

Its principal ore is the *sulphide* or *native cinnabar* (HgS), from which metallic mercury is obtained by distillation. Mercury is a brilliant, bluish-white or silvery white, inodorous, and tasteless metal. It is fluid at ordinary temperature, freezes at $-40°$ F., and boils at 662° F. It is very heavy, having a specific gravity, at 60°, of 13·56. It may contain lead, tin, zinc, bismuth, &c., as impurities. When pure, it is not affected when freely exposed to the air, but when contaminated it becomes covered with a grey powder, has a dull instead of a lustrous appearance, does not quickly form spherical globules when broken, and when run over white paper it leaves a trail behind.

Therapeutics.—Pure metallic mercury is inert in the system, and only becomes operative when it is oxidised and salified. This explains the action of such preparations as grey powder, blue pill, and ointment, all of which preparations, although made from metallic mercury, contain a variable proportion of oxide. All the compounds of mercury are more or less active, but they differ widely in the promptness and intensity of their action and local effect; this depends in great measure on their comparative solubility; possibly the sulphides are inert. When a mercurial preparation is given in medicinal doses, it sooner or later, according to circumstances, produces a group of symptoms which are collectively termed mercurial action, salivation or mercurialism, and which no other substance can excite. It may be induced quickly by a single dose, or slowly by repeated small doses. In the former case it is violent in degree, in the latter it generally begins mildly, and can be usually regulated in degree by the will of the practitioner. The first symptoms of its action are to be looked for in the mouth, and are slight fœtor of the breath, and metallic taste; if its administration is continued, the gums become swollen, soft, and spongy, bleeding on the least abrasion, and there is a decided increase of saliva. If pushed further, these symptoms are all intensified. The gums are swollen and vascular, the tongue, submaxillary and parotid glands are enlarged, the teeth become loose, salivation is profuse, and the saliva is ropy and viscid, and there is a distinct febrile reaction of a low type. The parts may even ulcerate and slough, and necrosis of the jaw-bone has occurred, and death from exhaustion. During severe salivation emaciation goes on rapidly, and exudations frequently disappear. The blood becomes more fluid and watery, and its power of coagulation is impaired. Its solid constituents (WRIGHT), as albumen, fibrin, and red corpuscles, are diminished. Hence it is termed an alternative. Sometimes the nervous system is chiefly affected, and mercurial palsy is the result, the symptoms resembling those of paralysis agitans. This condition is generally due to the inhalation of the vapour of mercury, as in workers in the metal. In others it appears to excite eczematous and other skin eruptions, or to produce a cachectic condition, with genuine debility of body and mind. The general indications in the treatment of mercurialism, after stopping the use of the drug, are to preserve the patient from exposure to cold and damp, without keeping the body too warm; to allay internal pain by opiates and soothing applications; to reduce inflammatory symptoms by the cautious use of local depletion and antiphlogistics; to allay febrile symptoms by mild saline purgatives or effervescing salines; to employ diffusible stimulants if there be great weakness or threatening syncope; to apply weak vegetable or mineral astringent lotions, or a lotion of chlorate of potash, to the mouth and throat when there is profuse salivation ; to correct fœtor of the breath by a well-diluted gargle or wash of chlorinated soda, or solution of permanganate of potash ; to support the patient by bland, nutritious food; and finally, to facilitate the removal of the poison from the system, which may be promoted by the use of iodide of potassium. Mercurials are contra-indicated in all cases of genuine debility and impoverished states of the blood, in anæmia, scurvy, hectic, tuberculous and scrofulous diatheses, fatty degeneration of the heart, fatty or granular degeneration of the kidneys, &c. Patients are occasionally met with who manifest the symptoms of mercurialism after the most minute doses of any of the preparations; these are examples of the influence of idiosyncracy. Mercurialism is not easily established in children ; the drug passes off by the bowels, giving the evacuations the characteristic *chopped spinach* appearance. Mercurials are said to act as alteratives, absorbents, antiphlogistics, antisyphilitics, &c. As antiphlogistics they are administered to control and diminish the inflammatory process, and to prevent exudation, or to stimulate the absorption of effused fibrin by rendering it less adhesive, and promoting its disintegration. But we do not think that in inflammation much reliance can be put on their action on the blood, because it would take some time before the blood would be altered in its composition so as to diminish inflammation. Nor do we think it would be advisable to push their administration to such an extent, as the remedy then might be worse than the disease. Any benefit which follows their use in these cases is more probably due to the increased functional activity of the glandular system, by which a certain amount of counter-irritation and derivation of blood from other parts is produced. This helps to explain why mercury is not found suitable in acute inflammation of glandular structures, and why it is useful in inflammation of serous membranes, &c. As an antiphlogistic, then, mercury may be given in iritis, pericarditis, peritonitis, pleurisy, &c., at the outset of the attack, during the stage of exudation, and afterwards to diminish the inflammatory process, and to promote absorption of the effused products. It should not, however, be given in adynamic inflammation, or when the exudation is serous rather than fibrous. *As an antisyphilitic.*—Formerly it was believed that mercury was a specific for syphilis, and it was frequently so rashly administered that the patient suffered from mercurial poisoning as well as syphilis, and the symptoms of the latter disease were much aggravated. This at last began to be appreciated, and many have condemned its employment as being not only useless, but even injurious. This, however, the editor believes to be an extreme opinion, because, while admitting that it is not essential for the relief of syphilis, he has found it especially of value when the secondary eruptions are copious and disfigure the face, and in congenital syphilis of children. It is only the remedy for some of its symptoms, and is only one of the means that should be employed in treating the disease. Its action in these cases being confined to its effect on the skin it has also been said to increase the number of red blood-corpuscles, but in the cases treated in the Lock Hospital, in which this increase of red corpuscles was noted, the factors of rest, nourishing food, &c., were not taken into account, and which probably had much more to do with the increase of the red corpuscles than small doses of mercury. Even taking for granted the increase of red corpuscles, that is not evidence of any antisyphilitic action; probably a chalybeate would have produced a still greater increase of red corpuscles, and consequently a better result on the general health of the patient, as in syphilis, more perhaps than in any other disease, attention to improving the general health of the patient is the most successful treatment of the disease. They are given in combination with other purgatives in so-called bilious constipation, dyspepsia, and headache, and in some forms of jaundice; in glandular swellings, in rheumatism, &c., &c. Mercurials may be administered by the stomach or by the rectum ; by inhalation of the vapour ; by fumigating the body (protecting the air-passages) either with the dry or moist fumes ; by simple inunction upon the skin, or by the endermic method of first removing the cuticle by a blister, and then dressing the wounded surface with the drug, or subcutaneously in the form of albuminate of corrosive sublimate. Infants may be brought under the influence of mercury by wrapping a flannel roller smeared with mercurial ointment round the body. Mercurials may be given in the mild form of minutely divided (and probably oxidised) mercury, as in grey powder, &c.; in the stronger form of protosalts; or in the still stronger form of persalts.

HYDRARGYRUM CUM CRETA—MERCURY AND CHALK (Grey Powder).—*Take of mercury, by weight,* 1 *ounce ; prepared chalk,* 2 *ounces. Rub the mercury and chalk in a porcelain mortar until metallic globules cease to be visible to the naked eye, and the mixture acquires a uniform grey colour.*

Therapeutics.—This is a heavy insoluble grey powder, containing chalk with finely divided and probably more or less oxidised mercury. It is given to children with rhubarb, or with carbonate of soda, as an alterative, antacid, and purgative, in diarrhœa, and cutaneous eruptions, depending upon irritability of the alimentary canal, and as an alterative in syphilis. It is the mildest of the mercurial preparations and is suitable, also, as an alterative, for feeble adults.

Dose.—3 to 8 grains.

PILULA HYDRARGYRI—Mercurial Pill (Blue Pill).—*Take of mercury,* 2 *ounces; confection of roses,* 3 *ounces; liquorice root, in fine powder,* 1 *ounce. Rub the mercury with the confection of roses until metallic globules are no longer visible, then add the liquorice, and mix the whole well together.*

Therapeutics.—A soft bluish-black mass, containing finely divided and partially oxidised mercury.

Dose, as an alterative, 2 or 3 grains, repeated at intervals according to circumstances; as a cholagogue, added to other purgatives, 3 to 5 grains; in doses of 10 to 15 grains, it acts alone as a purgative.

EMPLASTRUM HYDRARGYRI—Mercurial Plaster.—*Take of mercury,* 3 *ounces; olive oil,* 56 *grains; sublimed sulphur,* 8 *grains; lead plaster,* 6 *ounces. Heat the oil and add the sulphur to it gradually, stirring until they unite; with this mixture triturate the mercury until globules are no longer visible, then add the lead plaster previously liquefied, and mix the whole thoroughly.*

EMPLASTRUM AMMONIACI CUM HYDRARGYRO—Ammoniac and Mercury Plaster.—*Take of ammoniacum,* 12 *ounces; mercury,* 3 *ounces; olive oil,* 56 *grains; sublimed sulphur,* 8 *grains. Heat the oil and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury, until the globules are no longer visible; and lastly, add the ammoniacum, previously liquefied, mixing the whole carefully.*

Therapeutics.—These plasters are employed as stimulant and discutient applications to glandular enlargements, over the liver in chronic induration and enlargement; to indolent buboes, syphilitic nodes, &c.

LINIMENTUM HYDRARGYRI—Liniment of Mercury.—*Take of ointment of mercury,* 1 *ounce; solution of ammonia, liniment of camphor, of each* 1 *fluid ounce. Liquefy the ointment of mercury in the liniment of camphor with a gentle heat; then add the solution of ammonia gradually, and mix with agitation.*

Therapeutics.—Employed as a stimulant and discutient application to indolent tumours, chronic enlargements of the joints, &c. It readily produces salivation.

SUPPOSITORIA HYDRARGYRI—Mercurial Suppositories.

Preparation.—*Take of ointment of mercury,* 60 *grains; oil of theobroma,* 120 *grains. Melt the oil of theobroma with a gentle heat,* *then add the ointment of mercury, and, having mixed them thoroughly without applying more heat, immediately pour the mixture, before it has congealed, into suitable moulds, of the capacity of* 15 *grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

Therapeutics.—Found efficacious in destroying ascarides of the rectum, and as a local application for irritable or disordered conditions of its mucous membrane, which occasionally follow operative interference with it. It also presents a much easier method of bringing the system under the influence of mercury than inunction, when for any cause it is deemed inadvisable to administer the drug by the mouth.

UNGUENTUM HYDRARGYRI—OINTMENT OF MERCURY (Blue Ointment.)—*Take of mercury, prepared lard, of each* 1 *pound; prepared suet,* 1 *ounce. Rub them together until metallic globules cease to be visible.*

Therapeutics.—A soft bluish-black ointment, containing finely divided and probably partially oxidised mercury. It is employed as a discutient to indolent tumours, and, in conjunction with the internal use of mercurials, to produce salivation; for the latter purpose it is rubbed into the most tender parts of the skin, as on the inner sides of the thighs, into the axillæ, &c., or it may be applied endermically to a blistered surface. It has been recommended as an application over deep-seated acute inflammations, in orchitis, in erysipelas, &c.

UNGUENTUM HYDRARGYRI COMPOSITUM—Compound Ointment of Mercury.

PREPARATION.—*Take of ointment of mercury,* 6 *ounces; yellow wax, olive oil, of each* 3 *ounces; camphor,* 1½ *ounce. Melt the wax with a gentle heat, and add the oil; then incorporate the ointment of mercury, and when the mixture is nearly cold, add the camphor in powder, and mix the whole thoroughly together.*

Therapeutics.—This ointment combines the medicinal properties of the mercurial ointment and camphor. The wax and oil are added to give it body, as the combination of camphor with mercurial ointment is too fluid for convenient use. It is used as a stimulant deobstruent ointment in cases of swollen scrofulous glands, chronic buboes, &c.

Hydrargyri Oxidum Nigrum (Hg_2O)—Black Oxide of Mercury—Suboxide of Mercury—Protoxide of Mercury—is a dark greyish-black, tasteless, and inodorous powder, which is insoluble in water, and is decomposed by the influence of light and air, being converted into metallic mercury and oxide. It may be prepared by throwing calomel into lime water, whereby the subchloride of mercury is precipitated as suboxide, chloride of calcium being formed in solution, $2HgCl + CaO = Hg_2O + CaCl_2$. This constitutes

LOTIO HYDRARGYRI NIGRA—Black Mercurial Lotion—Black Wash.—*Take of subchloride of mercury,* 30 *grains; solution of lime,* 10 *fluid ounces. Mix.*

Therapeutics.—Black wash i sa standard preparation in all hospitals. Its name sufficiently explains its appearance. It is applied as a mild alterative application to chancres and other syphilitic sores, and also to a variety of non-syphilitic sores, such as cancrum oris, foul and indolent ulcers, &c. The black oxide is sometimes used for fumigation, but is never administered internally. An ointment is sometimes prepared from it, which is used for purposes similar to those to which black wash is applied.

Hydrargyri Oxidum Rubrum (HgO)—Red Oxide of Mercury—Red Precipitate.

PREPARATION.—*Take of mercury, by weight,* 8 *ounces; nitric acid,* 4½ *fluid ounces; water,* 2 *fluid ounces. Dissolve half the mercury in nitric acid diluted with the water, evaporate the solution to dryness, and with the dry salt thus obtained triturate the remainder of the mercury until the two are uniformly blended together. Heat the mixture in a porcelain dish, with repeated stirring, until acid vapours cease to be evolved, and, when cold, enclose the product in a bottle.*

Characters.—An orange-red powder, readily dissolved by hydrochloric acid, yielding a solution which, with caustic potash added in excess, gives a yellow precipitate, and with solution of ammonia a white precipitate. Entirely volatilised at a temperature under redness, being at the same time decomposed into mercury and oxygen.

Hydrargyri Oxidum Flavum (HgO)—Yellow Oxide of Mercury.

PREPARATION.—*Take of perchloride of mercury,* 4 *ounces; solution of soda,* 2 *pints; distilled water, a sufficiency. Dissolve the perchloride of mercury in* 4 *pints of distilled water, aiding the solution by the application of heat, and add this to the solution of soda. Stir them together; allow the yellow precipitate to subside; remove the supernatant liquor by decantation; thoroughly wash the precipitated oxide on a calico filter; and finally dry it by the heat of a water-bath.*

Characters and Tests.—A yellow powder, readily dissolved by hydrochloric acid, yielding a solution which, with solution of ammonia, gives a white precipitate. It is entirely volatilised when heated to incipient redness; being resolved into oxygen gas and the vapour of mercury.

Therapeutics.—The yellow and red oxides are identical in chemical composition. The yellow oxide, when long kept, loses its bright colour and becomes greyish, which is probably due to partial reduction. This oxide is used like the red oxide, and, from being in a finer state of division, is preferred by some.

LOTIO HYDRARGYRI FLAVA—YELLOW MERCURIAL LOTION—YELLOW WASH.—*Take of perchloride of mercury,* 18 *grains; solution of lime,* 10 *fluid ounces. Mix.*

Therapeutics.—Yellow wash is simply peroxide of mercury suspended in the liquid. It is employed for purposes similar to those for which the red precipitate ointment is used.

UNGUENTUM HYDRARGYRI OXIDI RUBRI—OINTMENT OF RED OXIDE OF MERCURY—Unguentum Hydrargyri Nitrico-Oxidi, *Lond.* (Red Precipitate Ointment).—*Take of red oxide of mercury in very fine powder,* 62 *grains; hard paraffin,* $\frac{1}{4}$ *ounce; soft paraffin,* $\frac{3}{4}$ *ounce. Melt the hard and soft paraffin together, and when the mixture in cooling begins to thicken add the oxide of mercury in a glass or porcelain mortar, and mix the whole thoroughly.*

Therapeutics.—Red oxide of mercury has been given internally in doses of from $\frac{1}{12}$ of a grain upwards, but in consequence of its uncertain character and its irritant poisonous properties, it is very rarely administered. Externally it is applied, either sprinkled in powder upon the part, or in the form of ointment, as a caustic to unhealthy granulations, chronic indolent ulcers, soft warts, ophthalmia tarsi, chronic conjunctivitis, &c. It may cause salivation, and therefore ought to be applied with care.

Hydrargyri Iodidum Rubrum (HgI_2)—Red Iodide of Mercury. Mercuric Iodide.

PREPARATION.—*Take of perchloride of mercury,* 4 *ounces; iodide of potassium,* 5 *ounces; boiling distilled water,* 4 *pints. Dissolve the perchloride of mercury in* 3 *pints, and the iodide of potassium in the remainder of the water, and mix the two solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding* 212° F. (100° C.).

Characters.—A crystalline powder of a vermilion colour, becoming yellow when gently heated over a lamp on a sheet of paper, almost insoluble in water, dissolves sparingly in alcohol, but freely in ether, or in an aqueous solution of iodide of potassium. When digested with solution of soda, it assumes a reddish-brown colour, and the fluid, cleared by filtration and mixed with solution of starch, gives a blue precipitate on being acidulated with nitric acid.

UNGUENTUM HYDRARGYRI IODIDI RUBRI—Ointment of Red Iodide of Mercury.—*Take of red iodide of mercury, in fine powder,* 16 *grains; simple ointment,* 1 *ounce. Mix thoroughly.*

Dose.—$\frac{1}{32}$ to $\frac{1}{8}$ of a grain, in pill or in solution, with iodide of potassium.

Therapeutics.—Red iodide of mercury acts in over-doses as a powerful irritant poison, resembling corrosive sublimate; and even in medicinal doses it may cause great irritation and salivation. Externally, it acts as a powerful caustic, causing inflammation of the skin when applied to it. In medicinal doses it is alterative, stimulant, and deobstruent. It is employed in syphilitic and strumous affections, in a variety of cutaneous diseases, in epilepsy, in syphilitic rheumatism, in chronic glandular enlargements, &c. Externally, it has been used in bronchocele, in lupus, ophthalmia tarsi, chronic glandular enlargements, &c. Its application to broken surfaces requires great caution, and causes very severe pain.

Hydrargyri Subchloridum ($HgCl$)—Subchloride of Mercury—Calomel—Mercurous Chloride.

Preparation.—Take of sulphate of mercury, 10 ounces; mercury, 7 ounces; chloride of sodium, dried, 5 ounces; boiling distilled water, a sufficiency. Moisten the sulphate of mercury with some of the water, and rub it and the mercury together until globules are no longer visible; add the chloride of sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling distilled water until the washings cease to be darkened by a drop of sulphide of ammonium. Finally, dry at a heat not exceeding 212° F. (100° C.), and preserve in a jar or bottle impervious to light.

Characters.—A dull-white, heavy, and nearly tasteless powder, rendered yellowish by trituration in a mortar; insoluble in water, spirit, or ether. Digested with solution of potash, it becomes black; and the clear solution, acidulated with nitric acid, gives a copious white precipitate with nitrate of silver. Contact with hydrocyanic acid also darkens its colour. When sufficiently heated it is entirely volatilised. Warm ether which has been shaken with it in a bottle leaves, on evaporation, no residue.

PILULA HYDRARGYRI SUBCHLORIDI COMPOSITA—COMPOUND PILL OF SUBCHLORIDE OF MERCURY—PLUMMER'S PILL.—*Take of subchloride of mercury, sulphurated antimony, of each,* 1 *ounce. guaiacum resin, in powder,* 2 *ounces ; castor oil,* 1 *fluid ounce, or a sufficiency. Triturate the subchloride of mercury with the antimony; then add the guaiacum resin and castor oil, and beat the whole into a uniform mass.*

UNGUENTUM HYDRARGYRI SUBCHLORIDI—OINTMENT OF SUBCHLORIDE OF MERCURY.—*Take of subchloride of mercury,* 80 *grains ; benzoated lard,* 1 *ounce. Mix thoroughly.*

Dose.—Of calomel, as an alterative, ½ grain to 2 grains; as a purgative, 2 to 6 grains ; to produce symptoms of mercurialism, 1 grain, combined with ⅙ of a grain of opium, every hour, or in larger doses at longer intervals. Of the compound calomel pill, as an alterative and diaphoretic, 5 to 10 or more grains ; there is a grain each of calomel and of sulphurated antimony in 5 grains of the pill. Calomel may be given in pill or in powder, either alone or in combination with other alteratives (as in the compound pill), or purgatives.

Therapeutics.—Calomel acts as a mild but sure mercurial, and may usually be taken in very large doses with impunity ; but on the other hand, so small a quantity as 5 grains has caused fatal salivation, and deaths have followed the administration of comparatively small quantities. In small doses, calomel acts as an alterative, and as such is given in a variety of cases, including syphilitic and other chronic skin diseases, affections of the liver, glandular enlargements, &c. As an antiphlogistic, it is given in febrile and inflammatory affections ; as a purgative, it is usually given in combination with other cathartics, whose effects it tends to promote by stimulating the liver and intestinal glands to increased activity, and is employed as such in sluggish states of the liver, with constipation, jaundice, at the outset of inflammatory diseases, &c. It does not, however, act directly on the liver (BENNET, RUTHERFORD, and VIGNAL), but indirectly it increases the elimination of bile from the intestinal canal, and hence it is especially useful in unloading the portal circulation in various derangements of that organ, whether acute or chronic. In hot climates it is used in large doses (15 to 20 grains) as a sedative, as in cholera, dysentery, yellow fever, &c. Plummer's pill is a favourite alterative remedy employed in syphilitic and other chronic skin diseases, in chronic rheumatism, &c. Calomel ointment is applied to chronic cutaneous diseases, &c. Calomel is also frequently added in minute quantity to other remedies as diaphoretics, diuretics, anthelmintics, &c., to promote their special effects.

Hydrargyri Perchloridum ($HgCl_2$)—Perchloride of Mercury—Corrosive Sublimate—Mercuric Chloride.

PREPARATION.—*Take of persulphate of mercury,* 20 *ounces; chloride of sodium, dried,* 16 *ounces; black oxide of manganese, in fine powder,* 1 *ounce. Reduce the persulphate of mercury and the chloride of sodium each to fine powder, and having mixed them and the oxide of manganese thoroughly by trituration in a mortar, put the mixture into an apparatus adapted for sublimation, and apply sufficient heat to cause vapours of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation.*

Characters.—In heavy colourless masses of prismatic crystals, possessing a highly acrid metallic taste, more soluble in alcohol, and still more so in ether than in water. Its aqueous solution gives a yellow precipitate with caustic potash, a white precipitate with ammonia, and a curdy white precipitate with nitrate of silver. When heated it sublimes without decomposing or leaving any residue.

Dose.—From $\frac{1}{16}$ to $\frac{1}{8}$ of a grain, in pill or solution, taken after meals. Externally, from a $\frac{1}{4}$ of a grain to a grain to each ounce of the vehicle, as a lotion.

LIQUOR HYDRARGYRI PERCHLORIDI—Solution of the Perchloride of Mercury.—*Take of perchloride of mercury, chloride of ammonium, of each,* 10 *grains; distilled water,* 1 *pint. Dissolve.*

The chloride of ammonium is used to increase the solvent power of the water, and prevent reduction of the mercuric salt to mercurous. It is a very useful form for administering the perchloride. 1 fluid drachm contains $\frac{1}{16}$ of a grain of the salt. The dose is from $\frac{1}{2}$ to 2 fluid drachms thrice a day.

Therapeutics.—Corrosive sublimate in overdoses acts as a powerful corrosive irritant poison. 3 grains have destroyed the life of a child, but much larger doses have been followed by recovery, either in consequence of free spontaneous vomiting, or of the employment of remedial measures. The promptness and energy of the poison will depend upon the state of the stomach with respect to food; if it be swallowed after a meal, comparatively little injury may ensue if it be immediately expelled; but when taken on an empty stomach, even small medicinal doses are apt to cause great irritation. Death may follow a poisonous dose at any time between three to five or ten hours and five or more days after swallowing it. The symptoms attending acute poisoning by corrosive sublimate are manifested immediately after it is taken, and are more or less as follows:—There is the strong nauseous metallic taste of the poison, a burning heat and a feeling of constriction in the throat and gullet, extending to the stomach, causing painful and difficult swallowing and breathing; the tongue is contracted, and its surface, in common with that of the whole cavity of the mouth, is whitened, and occasionally there are early symptoms of salivation, with swelling of the tongue, gums, and lips; vomiting then follows, and causes great suffering, the vomited matters being mixed with stringy mucus and blood; there is usually intense pain in the region of the stomach, and the whole surface of the abdomen is intolerant of pressure; there is severe purging, the evacuations containing more or less of mucus and blood; the urinary organs are often implicated, the urine being scanty, and its passage very painful; there is great nervous depression; the pulse is small, weak, and frequent, thready and irregular; the face is often flushed and swollen, at other times shrunken, pale and anxious, and the surface of the body is cold and clammy; death may be preceded by convulsions, or by stupor, or fatal syncope may occur without them. If the patient survive a few days, salivation, ulceration of the mouth, severe dysenteric purging, and the symptoms arising from destruction of portions of the tissues of the alimentary canal, may ensue. Poisoning by corrosive sublimate may take place slowly, by the administration of small doses, and serious effects may follow its external use when applied to broken surfaces. The symptoms of acute poisoning by corrosive sublimate are generally more promptly manifested, the taste of the poison is more marked, the heat and constriction of the gullet are more intense, and are present before vomiting commences, the evacuations are more frequently mixed with blood, and the urinary organs are more implicated than in poisoning by *arsenic*. *Treatment.*—Albumen, as it forms a sparingly soluble compound, but soluble in excess of albumen, give therefore white of eggs or wheaten flour, milk or protochloride of tin; failing albumen, opiates and demulcents, and treat the symptoms of salivation as they arise.

Medicinally, corrosive sublimate acts as an alterative, seldom producing salivation; it should be given after meals, in order to avoid the irritation which it is apt to cause when given on an empty stomach, and if it still cause irritation, it may be combined with a little opium. It is given in secondary syphilis, in a variety of chronic syphilitic and other diseases of the skin, in strumous affections, chronic rheumatism, ophthalmia, arthritis, periosteal affections of a syphilitic origin, &c. Externally, it acts as an escharotic, and is not without danger, either from the violence of its local effects, or in consequence of its absorption ; it has been employed as an alterative lotion, collyrium, or injection, it has been found beneficial in cutaneous diseases, ophthalmia, prurigo, &c.

Hydrargyrum Ammoniatum (NH_2HgCl) — Ammoniated Mercury—Hydrargyri Ammonio-Chloridum—Ammonio-Chloride of Mercury—Hydrargyri Præcipitatum Album—White Precipitate.

PREPARATION.—*Take of perchloride of mercury*, 3 *ounces; solution of ammonia*, 4 *fluid ounces; distilled water*, 3 *pints. Dissolve the perchloride of mercury in the water with the aid of a moderate heat; mix the solution with the ammonia, constantly stirring; collect the precipitate on a filter, and wash it well with cold distilled water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a temperature not exceeding* 212° F. (100° C.).

Characters.—An opaque white powder, on which cold water, alcohol, and ether have no action. Digested with caustic potash, it evolves ammonia, acquiring a pale yellow colour, and the fluid, filtered, and acidulated with nitric acid, gives a white precipitate with nitrate of silver. Boiled with a solution of chloride of tin, it becomes grey, and affords globules of metallic mercury. Entirely volatilised at a temperature under redness without fusing. It should yield 77·5 per cent. of metallic mercury.

UNGUENTUM HYDRARGYRI AMMONIATI—OINTMENT OF AMMONIATED MERCURY—*Unguentum præcipitati albi*, Ed.—*Take of ammoniated mercury*, 50 *grains; simple ointment*, 450 *grains. Mix thoroughly.*

Therapeutics.—Ammoniated mercury acts as a powerful irritant poison; it is not used internally. Externally, it is employed in the form of the *white precipitate* ointment as an application in a variety of skin diseases, more especially those of an eczematous nature, in ophthalmia tarsi, to destroy pediculi, &c.

Liquor Hydrargyri Nitratis Acidus—Acid Solution of Nitrate of Mercury—Nitrate of Mercury ($Hg2NO_3$) in Solution in Nitric Acid.

PREPARATION.—*Take of mercury*, 4 *ounces; nitric acid*, 5 *fluid ounces; distilled water*, $1\frac{1}{2}$ *fluid ounce. Mix the nitric acid with water in a flask; and dissolve the mercury in the mixture without the application of heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle away from the light.*

Characters.—A colourless and strongly acid solution, which gives a yellow precipitate with solution of potash added in excess. If a crystal of sulphate of iron be dropped into it, in a little time the salt of iron, and the liquid in its vicinity, acquire a dark colour. Sp. gr. about 2·0.

Therapeutics.—Acid solution of nitrate of mercury acts as a powerful and energetic caustic; it is never given internally, nor should it be applied to extensive surfaces, as it is apt to be absorbed and cause salivation, besides giving rise to severe local pain. During its application, the surrounding parts must be carefully protected. It has been employed in lupus, and to other aggravated chronic skin disease, to phagedenic, syphilitic, cancerous, and other spreading ulcerations, to ulcerations of the cervix uteri, to primary chancre, &c.

UNGUENTUM HYDRARGYRI NITRATIS—OINTMENT OF NITRATE OF MERCURY—UNGUENTUM CITRINUM, Ed.—*Take of mercury, by weight,* 4 *ounces; nitric acid,* 12 *fluid ounces; prepared lard,* 15 *ounces; olive oil,* 32 *fluid ounces. Dissolve the mercury in the nitric acid with the aid of a gentle heat; melt the lard in the oil, by a steam or water-bath, in a porcelain vessel capable of holding six times the quantity; and while the mixture is at about* 212° F. (100° C.), *add the solution of mercury, also at about the same temperature, mixing them thoroughly. If the mixture do not froth up, increase the heat till this occurs. Keep it stirred until it is cold.*

UNGUENTUM HYDRARGYRI NITRATIS DILUTUM—DILUTED OINTMENT OF NITRATE OF MERCURY.—*Take of Nitrate of Mercury Ointment,* 1 *ounce; soft paraffin,* 2 *ounces, and mix.*

Therapeutics.—Ointment of nitrate of mercury, or citrine ointment, acts somewhat as an irritant when employed of official strength, and also as a stimulant and alterative. It may be diluted to any degree by the addition of prepared lard. It is used, sufficiently diluted, as an eye salve in chronic ophthalmia, in ophthalmia tarsi, and in granular conjunctivitis; it is also applied to a variety of chronic skin diseases, to indolent ulcers, &c.

HYDRARGYRI SULPHURETUM (HgS) (not official)—Sulphuret of Mercury—Red Sulphuret of Mercury—Cinnabar—Vermilion—occurs native, and is the ore from which metallic mercury is chiefly extracted. It occurs either as a tasteless, inodorous, brilliant red powder, permanent in air, and insoluble in water and alcohol, or as a dark red coloured crystalline mass. Cinnabar acts as an alterative, but is rarely used internally; externally it is employed in quantities of from 20 to 50 or 60 grains, to fumigate ulcers and certain skin diseases; it has also been used to fumigate the throat, but the sulphurous acid generated at the time is exceedingly irritating, so that the suboxide of mercury is preferable.

HYDRARGYRI PERSULPHAS ($HgSO_4$)—Sulphate of Mercury.

PREPARATION.—*Take of mercury, by weight,* 20 *ounces; sulphuric acid,* 12 *fluid ounces. Heat the mercury with the sulphuric acid in a porcelain vessel, stirring constantly, until the metal disappears, then continue the heat until a dry white salt remains.*

Characters.—A white crystalline heavy powder, rendered yellow by affusion of water. Entirely volatilised by heat.

It is employed in the preparation of corrosive sublimate and calomel, and is not given as a remedy.

ARGENTUM (Ag=108—Silver)—the Luna or Diana of the alchemist, ☽ —occurs native either massive, arborescent, or crystallised, but is seldom pure, also in the form of sulphide and chloride, and alloyed with other metals. It may be obtained from argentiferous sulphide of lead by roasting and cupellation, or by reducing other sulphides of silver by amalgamation. Silver is an exceedingly brilliant, white, malleable, and ductile metal, having a specific gravity of 10·5. It melts at a bright red heat, said to be 1873°, and when in a state of fusion is extremely brilliant. It does not readily oxidise, but quickly tarnishes by the action of sulphuretted hydrogen.

ARGENTUM PURIFICATUM—REFINED SILVER—PURE METALLIC SILVER.—If ammonia be added in excess to a solution of the metal in nitric acid, the resulting fluid exhibits neither colour nor turbidity.

Argenti Nitras ($AgNO_3$)—Nitrate of Silver—Lunar Caustic.

PREPARATION.—*Take of purified silver,* 3 *ounces; nitric acid,* 2½ *fluid ounces; distilled water,* 5 *fluid ounces. Add the nitric acid and the water to the silver in a flask, and apply a gentle heat till the metal is dissolved. Decant the clear liquor from any black powder which may be present, into a porcelain dish, evaporate and set aside to crystallise; pour off the liquor, and again evaporate and crystallise. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. To obtain the nitrate in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds. Nitrate of silver must be preserved in bottles, carefully stoppered.*

Characters.—In colourless tabular crystals, the primary form of which is the right rhombic prism, or in white cylindrical rods, soluble in distilled water, and in rectified spirits; the solution gives with hydrochloric acid a curdy white precipitate, which darkens by exposure to light, and is soluble in solution of ammonia. A small fragment, heated on charcoal with a blow-pipe, first melts, and then deflagrates, leaving behind a dull white metallic coating.

ARGENTI ET POTASSII NITRAS—Nitrate of Silver and Potassium—Mitigated Caustic.—Prepared by fusing one part of nitrate of silver with two parts of nitrate of potassium, and casting the mixture in the form of pencils or cylindrical cones, of a white or greyish-white colour.

Dose.—$\frac{1}{4}$ of a grain to 2 or 3 grains, made into pill with a vegetable extract. It is frequently made into pills with bread crumb, and it is doubtful whether the chloride of sodium contained in the bread interferes with the action of the remedy. Lotions and washes of nitrate of silver are made of various strengths, from 1 or 2 to 20 or nore grains to the ounce of distilled water. Fused *lunar caustic* and mitigated caustic are used in the solid form externally.

Therapeutics.—Nitrate of silver in over-doses acts as a powerful corrosive poison; but there are very few cases of fatal poisoning by it on record. *Antidotes,* common salt to precipitate the chloride, demulcent drinks to facilitate vomiting; subsequent treatment according to circumstances. Medicinally it acts as a sedative, alterative, astringent, antispasmodic, and tonic, when given internally; and as an alterative, astringent, stimulant, vesicant, and easily manageable mild caustic, when applied externally. When given internally for a considerable time, it is apt to cause a bluish, leaden, or indigo discoloration of the skin, which is permanent, and which—although it is said to be removable by the long-continued employment of iodide of potassium, bitartrate of potash, or dilute nitric acid—is generally believed to be indelible. Warning is said to be given of the approach of this discoloration by the appearance of a dark line along the edges of the gums; and it has been further stated that the discoloration does not supervene until the medicine has been continued upwards of three months. The cases for which it has been given internally are chiefly:—In affections of the alimentary canal, such as dyspepsia, nervous irritability of the stomach, ulcerations of the stomach, gastrodynia, pyrosis, obstinate chronic diarrhœa, acute and chronic dysentery and cholera, enemata containing the remedy being also employed in the cases in which its local application by such means is available; in spasmodic diseases, such as epilepsy, chorea, chronic hooping-cough, and spasmodic asthma; in locomotor ataxia, &c.; but as to its action as a nervine tonic our knowledge is purely empirical. Externally, either in lotions of various strengths, or in the solid form, it has been used chiefly in affections of the eye, such as catarrhal, purulent, scrofulous or gonorrhœal ophthalmia, ophthalmia tarsi, ulceration and opacity of the cornea, &c. ; in affections of the mouth, throat, and larynx, such as relaxed, ulcerated, and malignant sore throat, enlargement and ulceration of the tonsils, aphthous ulcerations, laryngitis, croup, diphtheria, ptyalism, &c. ; in affections of the genito-urinary organs, either in the solid form or by injections, such as leucorrhœa, ulcerations of the os and cervix uteri, cancer of the uterus, chronic inflammation of the neck of the uterus, pruritus pudendi, as a topical application to the os uteri in amenorrhœa, in chronic inflammation of the bladder, in spermatorrhœa, in gonorrhœa, primary chancres, &c.; in external affections, such as a variety of skin diseases, the pustules of small-pox, erysipelas, and other inflamed surfaces, the bites of rabid and poisonous animals, dissection wounds, unhealthy ulcers and granulations, chapped nipples, warts, corns, a variety of tumours and enlarged glands, &c.; to arrest the bleeding of leech bites and minute vessels, &c.

Argenti Oxidum (Ag_2O)—Oxide of Silver.

PREPARATION.—*Take of nitrate of silver, in crystals,* ½ *ounce; solution of lime,* 3½ *pints; distilled water,* 10 *fluid ounces. Dissolve the nitrate of silver in* 4 *ounces of the distilled water, and, having poured the solution into a bottle containing the solution of lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the distilled water, and dry it at a heat not exceeding* 212° F. (100° C.). *Keep it in a stoppered bottle.*

Characters.—An olive-brown powder, which at a low red heat gives off oxygen, and is reduced to the metallic state. It dissolves completely in nitric acid without the evolution of any gas, forming a solution which has the characters of nitrate of silver.

When recently prepared, this occurs as an olive-brown hydrated oxide, which gradually loses its water and becomes darker coloured as it is kept, being by long exposure to light decomposed into oxygen and suboxide, and finally reduced to metallic silver. It is an inodorous, tasteless powder, slightly soluble in water, the solution having an alkaline reaction.

Dose.—½ a grain to 1 or 2 grains, in pill; externally, as an ointment 60 grains to the ounce of lard.

Therapeutics.—Oxide of silver acts in the manner of the nitrate, but is very much milder in its topical effects, and is said to be less liable to cause discoloration of the skin, hence it ought to be prescribed in preference to the nitrate as a nervine tonic, its local action being almost *nil.* It has been recommended in the same cases as the nitrate, but is said to have a special action upon the uterus, and to be of use in menorrhagia, dysmenorrhœa, leucorrhœa, &c. In the form of ointment, it is applied, by means of a bougie, in gonorrhœa and gleet, and externally to venereal ulcers, &c.

AURUM (Au = 196·5)—Gold (Appendix).—Fine gold, in mass or leaf. The test solution of the terchloride is prepared by dissolving gold in nitro-hydrochloric acid, used as a test for atropine.

AURI ET SODII CHLORIDUM.—An orange-yellow, crystalline, deliquescent powder. It is official in the French Codex and U.S.P. The former consists of one molecule each of $AuCl_3$ and NaCl, the latter contains equal parts by weight of the two salts.

Dose.—$\frac{1}{30}$ to $\frac{1}{12}$ grain in pill.

Therapeutics.—Sometimes used as a caustic and given internally for syphilis.

PLATINUM (Pt = 195)—(Appendix).—Pure platinum in a state of minute division or in leaf. The test solution of the perchloride, $PtCl_4$, is prepared by dissolving thin platinum foil in nitrohydrochloric acid.

Therapeutics.—Perchloride of platinum is highly poisonous, but has been given in doses of $\frac{1}{10}$ to $\frac{1}{4}$ of a grain in syphilitic diseases.

PART III.—ORGANIC MATERIA MEDICA.

DIVISION I.—VEGETABLE KINGDOM.

CLASS I.—DICOTYLEDONES OR EXOGENÆ.

SUB-CLASS I.—THALAMIFLORÆ.

Nat. Ord. **RANUNCULACEÆ**—The Crow-foot Order—Buttercup Order.—Herbs, rarely shrubs, inhabiting cool moist climates in Europe and North America, and also met with at considerable elevations within the tropics. Many of the plants are poisonous, and have narcotico-acrid and sedative properties.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
ACONITUM NAPELLUS.	Leaves and root.	Britain and Germany.
PODOPHYLLUM PELTATUM.	Rhizome.	U.S. and Canada.
DELPHINIUM STAPHISAGRIA.	Seeds.	Southern Europe.
CIMICIFUGA RACEMOSA.	Rhizome.	U.S. and Canada.

Aconitum Napellus—Aconite—Monkshood, Wolfsbane, or Blue-rocket.

Botany.—Perennial herb. *Root*, tapering, with one or more lateral roots attached in summer. *Stem*, simple, erect and leafy; 2, 3, or more feet in height. *Leaves*, palmated and divided to the petiole into five wedged-shaped segments, each of which is deeply cleft into long and slender parts; smooth and shining, dark green above, paler underneath. *Inflorescence*, a long spike-like raceme of dark blue or deep violet-coloured flowers; the calyx consists of five petaloid sepals, the upper one of which is helmet-shaped, and the lateral ones are hairy on the inner side; the helmet is semicircular; the petals are five, of which the two upper are carried upon long stalks into the helmet, and there terminate in short horizontal sacks; the other petals are small and often abortive ; the stamens are filiform, and the filaments are hairy. *Fruit*, consists of three erect follicles. *Seeds*, numerous, angular, and wrinkled. *Flowering time*, May to July.

ACONITI FOLIA—*Aconite Leaves.* The fresh leaves and flowering tops of *Aconitum Napellus*, Linn., gathered when about one-third of the flowers are expanded, from plants cultivated in Britain.

Characters.—Leaves alternate, with long channelled stalks, very deeply cut into five or three segments, which are again deeply and irregularly divided into oblong acute narrow lobes ; exciting slowly, when chewed, a sensation of tingling and numbness.[1] Flowers large, irregular, deep blue, in a somewhat loose terminal raceme.[2]

ACONITI RADIX—*Aconite Root.* The root collected in the winter or early spring, before the leaves have appeared,[3] from plants cultivated in Britain,[4] and carefully dried ; or imported in a dried state from Germany.[4]

Characters.—Usually from 2 to 3 inches long, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick at the upper extremity,[5] where it is usually crowned with the remains of the base of the stem ;[5] conical in form, much shrivelled longitudinally,[5] and more or less covered with the scars and bases of broken rootlets ;[5] dark brown externally,[6] whitish within, and having a central cellular axis with about seven rays. No marked odour ;[7] taste at first somewhat bitterish sweet, but exciting slowly, when chewed, a prolonged sensation of tingling and numbness.

[1] This property they possess from the first, and it is retained until the seeds appear, but is entirely lost when these are ripe. [2] This distinguishes it from the denser racemes of *Aconitum ferox.* [3] The root acquires its greatest medicinal activity in winter and early spring. [4] The official tincture is ordered to be made with British cultivated roots. The German roots are collected in the mountainous districts by shepherds, who pay little regard to gathering the roots at the proper season, to the species they dig up, or to careful drying, and consequently such roots vary considerably in activity, and are not adapted for galenical preparations intended for internal use. [5] Roots of *Aconitum Japonicum* are shorter and smooth generally. The presence of a portion of the base of the stem distinguishes from the roots of *Aconitum ferox*, which are also larger, not so shrivelled and have fewer scars. [6] Several fatal cases of accidental poisoning have occurred in consequence of aconite root having been used as a garnish, by mistake for horse-radish. The latter root is white, or with a yellow tinge externally, and when scraped

develops a very pungent, irritating odour. [7] This distinguishes the root of masterwort, *Imperatoria Ostruthium*, which contains a volatile oil having an odour like bruised ivy leaves.

Active Principles.—The chief constituent is an alkaloid called *aconitine.* An alkaloid (*alkali* and εἶδος, *eidos*, likeness) may be defined as a compound organic base formed on the type of ammonia, and like it giving an alkaline reaction with test paper, and combining with acids to form salts. Some alkaloids, of which *conine*, $C_8H_{15}N$, may be taken as an example, contain three elements, and occur as volatile liquids, while others contain oxygen in addition, and occur as crystalline or amorphous solids. *Aconitine*, $C_{33}H_{43}NO_{12}$, is an example of the latter. Aconite root also contains a small proportion of *pseudaconitine* as well as *pricraconitine.* Commercial aconitine is, more or less, a mixture of these and other substances, some of which are probably formed during the process of extraction. The alkaloids exist in combination with *aconitic acid* in the plant.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum	Leaves	...	$\frac{1}{4}$ to 1 grain
Aconitina	Root	...	$\frac{1}{240}$ to $\frac{1}{60}$ grain
Linimentum	"	1 in $1\frac{1}{2}$	...
Tinctura	"	1 in 8	5 to 15 minims.

EXTRACTUM ACONITI—EXTRACT OF ACONITE.—*Take of the fresh leaves and flowering tops of aconite,* 112 *pounds. Bruise in a stone mortar, and press out the juice; heat it gradually to* 130° F. (54°·4 C.), *and separate the green colouring matter (chlorophyll) by a calico filter. Heat the strained liquor to* 200° F. (93°·3 C.) *to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup: then add to it the green colouring matter previously separated and passed through a hair sieve, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding* 140° F. (60° C.), *until the extract is of a suitable consistence for forming pills.*

This is Squire's process for making extracts from the fresh green parts of plants. The chlorophyll is separated because it would be destroyed at the temperature necessary to coagulate the albumen. The albumen is a nitrogenous substance liable to decomposition, and hence the necessity for its removal. The chlorophyll is again added to give the extract a fine green appearance, but it is no guarantee of good quality, and might be omitted altogether. The evaporation temperature is kept as low as possible, because a high temperature causes destructive changes in the active constituents.

TINCTURA ACONITI—TINCTURE OF ACONITE.—*Take of British cultivated aconite root, in No.* 40 *powder,* $2\frac{1}{2}$ *ounces; rectified spirit,* 1 *pint. Macerate the aconite root for forty-eight hours in* 15 *fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining* 5 *ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make* 1 *pint.*

The process here is that known as maceration and percolation. The maceration allows the menstruum to penetrate the tissues of the drug, and the active ingredients are washed out during the percolation. The menstruum must always be adapted to the character of the drug. Those containing resinous substances or volatile oils require rectified spirit, while many are exhausted by a mixture of spirit and water, and some by spirit and ether or ammoniated spirit. In this way tinctures come to be classified as alcoholic, proof, ethereal, or ammoniated, as the case may be.

LINIMENTUM ACONITI—LINIMENT OF ACONITE.—*Take of aconite root, in No.* 40 *powder,* 20 *ounces; camphor,* 1 *ounce; rectified spirit, a sufficiency. Moisten the aconite with* 20 *fluid ounces of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and adding more spirit, percolate slowly into a receiver containing the camphor, until the product measures* 30 *fluid ounces.*

In the 1867 B.P. 20 ounces of root yielded only 20 fluid ounces of liniment. The same quantity of root now yields 30 fluid ounces of an equally strong liniment, 20 fluid ounces of rectified spirit being insufficient to exhaust the root.

Aconitina—ACONITINE.—The details of the process are found by reference to the Pharmacopœia. It may be summarised as follows:—

1. Dissolve out the aconitate of aconitine from the root by rectified spirit, and recover the spirit by distillation.

2. Dissolve the residue in water to separate resin which is filtered out.

3. To the filtrate add ammonia which precipitates aconitine and forms aconitate of ammonium.

4. Collect and dry the precipitate. Digest in ether, which leaves impurities undissolved. Recover the ether by distillation.

5. Dissolve the residue in dilute sulphuric acid to form sulphate of aconitine. Add ammonia, by which aconitine, free of last traces of resin, is reprecipitated and sulphate of ammonium formed in solution.

6. Collect, wash with cold water, and dry the precipitated aconitine.

Characters and Tests.—A white, usually amorphous solid; solubility,[1] cold water, 1 in 150; boiling water, 1 in 50; rectified spirit, 1 in 6; chloroform, 1 in 5; and ether, 1 in 25. Strongly alkaline; precipitated by caustic alkalis, but not by ammonium carbonate or alkaline bicarbonates. It leaves no residue when burned with free access of air.[2] When rubbed on the skin produces a tingling sensation and prolonged numbness. It is a very active poison.

[1] English aconitine (see *Aconitum ferox*) requires for solution 4000 parts of water, 100 parts of ether, and 230 parts of chloroform.
[2] Showing absence of mineral impurities.

Official Preparation.

Unguentum, . . . 8 grains to 1 ounce.

UNGUENTUM ACONITINÆ—Ointment of Aconitine.—*Take of aconitine,* 8 *grains; rectified spirit,* ½ *fluid drachm; benzoated lard,* 1 *ounce. Dissolve the aconitine in the spirit, add the lard, and mix thoroughly.*

Therapeutics.—Aconite is an energetic poison. All parts of the official plant are poisonous, owing to the presence of the alkaloid *aconitine*, which is the most deadly of its official preparations. This alkaloid is very much allied in its action to delphinine, veratrine, and colchicine. The root is the most energetic part of the plant; and next in order, according to their activity, are the seeds, leaves, flowers, fruit, and stem. Even the smallest dose, such as cautiously chewing, without swallowing, a portion of one of the leaves or a slender shred of the root, or letting a drop or two of the tincture fall upon the tongue or lips, is followed by the physiological effects so characteristic of the plant, namely, a persistent numbness and burning taste, followed by a tingling of the parts touched, the sensation spreading to the throat. These effects are due to its being a local irritant and sedative, paralysing the sensory nerves. The following symptoms have been observed in cases of poisoning by aconite, all of which, however, are not necessarily present in every case, and their relative intensity will depend upon the manner in which the poison is taken, whether by one large dose or by the repetition of smaller quantities. In a few minutes, or at latest within an hour, after taking the poison, there is a feeling of warmth in the stomach and nausea, which, according to circumstances, may proceed to severe irritation, accompanied by pain in the abdomen, and may be followed by vomiting and purging. The sensation of warmth beginning at the stomach is gradually distributed over the rest of the body, and is followed by numbness, a feeling of distension and tingling in the lips, tongue, cheeks, and throat, to relieve the parched condition of which the patient makes constant efforts at swallowing. The numbness and tingling gradually spread over the rest of the body, and are very distinct in the upper limbs and at the tips of the fingers. There is loss of muscular power, with giddiness and a sense of weariness and disinclination for exertion, usually culminating in utter prostration. The sensibility of the skin is greatly diminished. The heart's action is remarkably reduced, both in strength and frequency, the pulse being weak, and in some cases not exceeding forty beats per minute, until the last stage arrives, when it usually rises into the small, weak, and frequent pulse of extreme debility. The respirations are also diminished in number and fulness, and are accomplished with more or less of effort. The pupil is at first contracted, but ultimately dilated, and there is dimness and confusion of sight. Towards the end, in a fatal case, the vertigo and depression of the vital powers are increased; the countenance is pale and anxious; the surface of the body is cold and clammy; the temperature is reduced (*vide* Bartholow, p. 411) to 92° Fahr., after ʒi of the tincture, and in Mr Jones' case to 84° after 2 oz. of B. P. tincture (*Brit. Med. Jour.*, 3rd March, 1877); the pulse is rapid, irregular, and almost imperceptible; the breathing is performed by an irregular succession of sighs ; there is frothing at the mouth, consciousness being commonly retained to the end. Occasionally the patient is completely paralysed; sometimes there is delirium, but the cerebral symptoms are rarely such as to deprive the patient entirely of consciousness; convulsions are seldom observed, though there are frequently tremblings or twitchings of the voluntary muscles ; sight, hearing, and speech may be partially or quite lost. Death generally takes place between one and eight hours after taking the poison, and is due to gradual failure of the heart's action and respiratory movements, although sometimes it occurs suddenly from syncope, especially after some exertion on the part of the patient ; and if life be sustained beyond the latter period, there is a probability of recovery, although the symptoms of depression will continue for several hours or longer. It is evident, therefore, that aconite paralyses the heart and its contained ganglia ; it paralyses also the muscles of respiration and the motor nerves ; it is an irritant to mucous membranes ; it increases the action of the skin and kidneys, and lowers the temperature. Aconite is, therefore, essentially a cardiac and motor depressant and paralyser of the sensory nerves. Medicinally, aconite is used as an anodyne, sedative, antiphlogistic, and diuretic. It was first brought into notice by Störck of Vienna, and by him and his followers recommended in a very numerous class of diseases. Dr Fleming of Birmingham also did much to raise the credit of aconite in this country.

It is employed, rubbed in locally, and at the same time administered internally, to relieve certain distressing local neuralgias, as tic-douloureux, pleurodynia, angina pectoris, &c. In such cases it is often of very great use. Its solutions in chloroform, or in a mixture of chloroform and alcohol, would appear, from the experiments of Dr Augustus Waller, to be much more readily absorbed by the skin, and consequently much more active as a local application, than simple alcoholic solutions. Hence it is good to combine its liniment with that of chloroform for external use. Though it sometimes gives marvellously good results in neuralgia, yet, it must be confessed, that it more frequently fails. If, however, it is to succeed, it does so after two or three applications, and it seems to be more suitable for cases of pure neuralgia from exposure to cold, with more or less febrile disturbance, than when the pain is secondary to the inflammation set up by the irritation of a carious tooth, or by the pressure of a tumour, &c. It is also frequently useful as a *sedative* and *anodyne* application in lumbago, sciatica, in the painful joints of chronic gout and rheumatism, in cutaneous hyperæsthesia, in the treatment of sprains and contusions, &c. Care must be taken that aconite be not rubbed in where there is broken skin, lest poisonous symptoms result from its too rapid absorption. Internally, it is administered as a sedative and anodyne in certain painful affections of the heart, as in the pain resulting from constricted mitral, in angina pectoris, pericarditis, and nervous palpitations; to facilitate the distressing agony resulting from internal aneurism; to calm the pain of cancer; to allay certain painful affections of the respiratory system, as in spasmodic asthma, emphysema, bronchitis, convulsive cough. It is often very beneficial in headache, when that coexists with a full bounding pulse and throbbing temples.

As an antiphlogistic, it is found useful in inflammatory diseases, such as cynanche tonsillaris, catarrhal croup, pleurisy, pneumonia, and in erysipelas. But it is only in the early stage of inflammation, while it is yet extending, that aconite does good.

Its diuretic properties are often beneficial in dropsies.

The administration of aconite in all cases requires careful watching to avoid inducing dangerous symptoms of depression.

Antidote.—There is no reliable chemical antidote ; evacuate the stomach by stimulant emetics, keep patient in recumbent posture, give alcoholic stimulants, ammonia or strong coffee, and inject hypodermically 4 minims liq. atropinæ sulph., or tincture of digitalis, they are physiological antidotes to the action of aconite on the heart (case of recovery after 1 ounce of Fleming's tincture had been taken, due to injection of digitalis.—*Brit. Med. Jour.*, 11th December, 1872).

Adulterations, Substitutions, &c.—German aconite frequently contains an admixture of other species, *A. Störckeanum* being the most common. The careless collection of the roots also causes deterioration in the quality. *A. Japonicum* (Japanese aconite) is imported in considerable quantity. It contains an alkaloid, *japaconitine*, differing from *aconitine*. *A. ferox*, a native of northern India, yields the root called *Bish*, *Bis*, or *Bikh*, Indian aconite root or Nepaul aconite. It is largely imported, and is the source of the alkaloid called *English aconitine*, *pseudaconitine*, *napelline*, *nepaline*, *acraconitine* or *feraconitine*. *Pseudaconitine*, $C_{36}H_{49}NO_{11}$, may be distinguished from *aconitine* by the following characters and tests. *Aconitine* is usually amorphous, but yields crystalline salts with acids: *pseudaconitine* is usually crystalline, but yields amorphous salts with the exception of the nitrate and the double chlorides with $AuCl_3$ and $PtCl_4$. *Pseudaconitine* becomes plastic in boiling water ; *aconitine* does not. *Aconitine* boiled with dilute sulphuric acid gives a solution which reduces Fehling's solution ; *pseudaconitine* does not. Aconitine, when heated with an alkali or dilute mineral acid, splits up into aconine and benzoic acid ; pseudaconitine, so treated, yields pseudaconine and dimethyl-proto-catechuic acid. The different solubilities have been already pointed out. *Pseudaconitine* is physiologically more active than *aconitine*. *A. heterophyllum*, *Atis* or *Atees*, is official in the Indian Pharmacopæia. It is remarkable as possessing no poisonous properties, and contains an alkaloid, *Atisine*, which acts simply as a tonic. The root of Masterwort (*Imperatoria Ostruthium*) has been met with as an adulteration in parcels of aconite root.

Podophyllum peltatum—Podophyllum.—May Apple or American Mandrake, or Wild Lemon.

Podophylli Rhizoma—Podophyllum Rhizome.—The dried rhizome and rootlets of *Podophyllum peltatum*, Linn.

Characters.—In pieces of variable length, from $\frac{1}{5}$ to $\frac{1}{3}$ of an inch thick ; flattened cylindrical, presenting at intervals large irregular tuberosities, marked above by a depressed circular scar, and giving off below a number of very brittle brownish rootlets, or, if these are broken off, presenting a corresponding number of whitish scars; dark reddish-brown or reddish-yellow, smooth or somewhat wrinkled; breaking with a short fracture, internally whitish and meally. Odour, faintly narcotic; taste bitterish, acrid, and nauseous.

Active Principles.—The rhizome and rootlets contain from 3½ to 5 per cent. of *podophyllin* which consists of nearly equal proportions of two resins, one soluble and the other insoluble in ether. Both strongly purgative. In many text-books the rhizome is said to contain the alkaloid *berberine*, and, perhaps partly for this reason, Bentham and Hooker place the plant in the nat. ord. Berberideæ. The colour of the resin is also attributed to its presence, but this is a mistake. Mayer reported *berberine* as one of its constituents in 1863, but Power in 1878 and Maisch in 1879 proved that such is not the case; that when found it is due probably to the accidental admixture of *Hydrastis Canadensis* root; and that the colour is due to acid colouring matters in the root.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Resina.	Rhizome	...	¼ to 1 grain
Tinctura	Resin	1 grain in 1 fluid drachm	15 to 60 minims

Preparation.—*Take of podophyllum rhizome, in No.* 40 *powder,* 1 *pound; rectified spirit,* 3 *pints, or a sufficiency; distilled water, a sufficiency. Exhaust the podophyllum with the spirit by percolation; place the tincture in a still, and draw off the greater part of the spirit. Slowly pour the liquid which remains after the distillation of the tincture into three times its volume of the distilled water, constantly stirring. Allow the mixture to stand for twenty-four hours to. deposit the resin. Wash the resin on a filter with distilled water, and dry it in a stove.*

This is the general process adopted by the American eclectic practitioners for the preparation of a class of active vegetable substances called resinoids, a term expressive of their somewhat indefinite composition. Euonymin, iridine, gelsemin, &c., are familiar examples. Sometimes a mineral acid or alum is added to the water to facilitate separation of the resin, but otherwise serving no purpose.

Characters.—An amorphous powder, varying in colour from pale yellow to deep orange-brown; soluble in rectified spirit and in ammonia; precipitated from the former solution by water, from the latter by acids. Partly soluble in pure ether. (It has a characteristic odour, and the powder sometimes causes painful irritation of the eyes and air passages of those who handle large quantities.)

TINCTURA PODOPHYLLI.—TINCTURE OF PODOPHYLLIN.—*Take of resin of podophyllum,* 160 *grains; rectified spirit,* 1 *pint; dissolve and filter.*

Therapeutics.—Podophyllum, but more commonly its resin, is employed as a cholagogue, or drastic cathartic, according to the dose. It somewhat resembles jalap in its action as a cathartic, producing copious liquid evacuations, which are at first of a bilious character. Podophyllin often causes griping, and sometimes nausea, and must be tried cautiously until its mode of action in each case is ascertained; for sometimes small doses act powerfully, whilst in other instances comparatively large doses have but little effect. While, then, there is no doubt as to its purgative action, there has been a great deal of discussion and difference of opinion as to its action on the liver, *i.e.*, its cholagogue power, which, however, we believe has been definitely settled in the affirmative by the experiments of Drs Rutherford and Vignal. Thus they found—(1) that it does increase the secretion of bile; (2) it acts more powerfully when it comes in contact with bile, which appears to be its proper solvent; (3) increase of the secretion is more marked when purgation is not severe; indeed, if the purgative effect is very decided, diminution, and not increase of the biliary secretion is the result; and (4) the action is due to direct hepatic stimulation, and not simply to emptying of the gall bladder.

These experiments are confirmed by the result of clinical experience. It is most useful in constipation, accompanying, or dependent on affections of the liver. In torpid liver, hepatic congestion, not inflammatory, in biliousness, jaundice, independent of structural change (*i.e.*, catarrhal), in congestion of the portal circulation. It is apt, however, to cause pain and griping, and is somewhat uncertain in its operation. It is best, therefore, to commence with a small dose —$\frac{1}{6}$ grain—and give it in combination with Ext. Belladonnæ or Hyoscyami. It may also advantageously be given with other purgatives, *e.g.*, Ext. Podophylli, grain $\frac{1}{6}$; Ext. Belladonnæ, grain $\frac{1}{4}$; Pil. Hydrargyri, grain iii. Fiat pil.

Delphinium Staphisagria—Stavesacre.

Botany.—An annual or biennial herb about from 3 to 4 feet high, and having a large tapering root. The whole plant is covered with long, soft, spreading hairs. *Leaves*, alternate, 4 to 5 inches in diameter, lower ones divided into 7 to 9, and higher ones more deeply into 5 to 7 lobes. Petioles long and hairy. Upper surface of the leaf almost smooth; under surface hairy on the veins; colour generally dull green. *Flowers*, on stout, very hairy stalks, rising from the axil of a leafy bract, and having two small bracts at the base of each stalk; usually arranged in lax panicles. *Sepals* 5, petaloid, irregular, spreading, very hairy outside, smooth within, colour varying from pink to purplish-blue, posterior one with a short spur projecting backward. *Petals*, usually 4, 2 posterior having a spur projecting into the pouch of the posterior sepal, 2 lateral slightly crisped on the margin. *Stamens*, numerous hypogynous; filaments curved, dilated below, anthers yellow. *Carpels*, 3, erect; styles long, smooth, shortly bifid. *Fruit*, 3 thick, oblong, hairy follicles, bearing remains of the style as a curved beak, and containing about 12 seeds in each follicle.

STAPHISAGRIÆ SEMINA—Stavesacre Seeds.—The dried ripe seeds of *Delphinum Staphisagria*, Linn.

Characters.—Irregularly triangular or obscurely quadrangular, arched, blackish-brown when fresh, but becoming dull greyish-brown by keeping. Testa wrinkled, and deeply pitted; nucleus soft, whitish, oily. No marked odour; taste nauseously bitter, and acrid.

Active Principles.—The active constituent appears to be the alkaloid *Delphinine*. The seeds also contain three other alkaloids, *staphisagrine*, *delphinoidine*, and *delphisine*. They yield to boiling ether 27 per cent. of a greenish-coloured non-drying fixed oil, which contains a considerable proportion of *delphinine*.

Official Preparation.

Unguentum, . . . contains 10 per cent. of oil.

UNGUENTUM STAPHISAGRIÆ—OINTMENT OF STAVESACRE. —*Take of Stavesacre seeds*, 4 *ounces; benzoated lard*, 8 *ounces; crush the seeds and macerate them in the lard kept melted over a water-bath for* 2 *hours. Strain through calico and set aside to cool.*

Therapeutics.—Stavesacre is a powerful depressant to the motor nerves, heart, and respiration, but is rarely given internally. The seeds have been used since very ancient times for the destruction of pediculi both on the human subject and on the lower animals. An ointment made with the oil extracted by ether has been used with considerable success by Dr Balmanno Squire, as a remedy in prurigo senilis. This makes an elegant ointment, and it would have been better had the suggestion been adopted in the Pharmacopœia.

Cimicifuga racemosa—Actæa racemosa.—Black snake-root. Black cohosh, Bugbane.

CIMICIFUGÆ RHIZOMA.—The dried rhizome and rootlets of *Cimicifuga racemosa*, Elliot.

Characters and Tests.—The rhizome is from 2 to 6 inches long, ½ to 1 inch thick, hard, flattened-cylindrical, having on its upper surface the remains of several aerial stems, and below numerous small wiry branched rootlets,[1] frequently broken off in commercial specimens. Rhizome and rootlets brownish-black, almost odourless,[2] taste slightly acrid; fracture close, that of the rootlets presenting a thick bark, and a central axis with from 3 to 5, usually 4, converging woody wedges, so as to assume a triangular, cross-like, or stellate appearance. An infusion is blackened by a persalt of iron.[3]

[1] Freshly dried specimens collected in the autumn are most active, and the rootlets appear to be more active than the rhizome. [2] It possesses a faint narcotic smell, which is more apparent when the drug is moistened with water. [3] Indicating tannic acid.

Active Principle.—No complete analysis of cimicifuga appears to have been made. Conard obtained an intensely acrid, neutral, crystalline principle. The composition of this substance and its physiological action were not ascertained, but it is probably the active constituent. The rhizome is the source of the eclectic resinoid *cimicifugin* or *macrotin*, an impure resin possessing the physiological properties of the drug.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum Liquidum,	Rhizome,	1 in 1	3 to 30 minims.
Tinctura, . . .	„	1 in 8	15 to 60 „

EXTRACTUM CIMICIFUGÆ LIQUIDUM—LIQUID EXTRACT OF CIMICIFUGA.—*Take of cimicifuga, in No.* 60 *powder,* 20 *ounces; rectified spirit, a sufficiency. Mix the cimicifuga with* 2 *pints of the spirit, macerate in a closed vessel for* 48 *hours; transfer to a percolator, and when the fluid ceases to pass, continue the percolation with more spirit until the cimicifuga is exhausted. Reserve the first* 15 *fluid ounces of the percolate,*[1] *evaporate the remainder by a water-bath to the consistence of a* *soft extract; dissolve this in the reserved portion, and make up the volume to 20 fluid ounces by the addition of more spirit.*

[1] This is an example of what in American pharmacy is called a valoid, that is, a liquid extract of which 1 fluid ounce represents the active constituents of 1 solid ounce of the drug. The first 15 fluid ounces contain the greater proportion of the active ingredients and are not subjected to evaporation in order to avoid destruction or loss of these substances by heat.

TINCTURA CIMICIFUGÆ — TINCTURE OF CIMICIFUGA — TINCTURA ACTÆÆ.—*Take of cimicifuga in No.* 40 *powder*, $2\frac{1}{2}$ *ounces; proof spirit*, 1 *pint*. Made by the same process as tincture of aconite.

CIMICIFUGIN OR MACROTIN—(*not official*).—Made by the same process as *podophyllin*. Dose, 1 to 6 grains in pill.

Therapeutics.—Cimicifuga was first introduced to medicinal use in this country by Sir James Y. Simpson in 1860. He found it very efficacious in lumbago, and it has been largely administered in neuralgia and acute rheumatisms. It is also employed as a stomachic and cardiac tonic in cases of weakened heart, and as an expectorant in bronchial catarrh and in phthisis. A strong tincture has been used in America as an external application in place of arnica, to which it is said to be much superior.

Adonis vernalis—Bird's Eye Adonis—(*not official*).—*Habitat*, Europe. Leaves and stalks contain the glucoside *adonidin*. *Dose.*—Of the powder, 3 to 6 grains ; infusion, 1 in 40, 2 to 4 drachms.

Therapeutics.—Similar to digitalis, but reputed not to be cumulative.

Anemone Pulsatilla—Pasque Flower Pulsatilla—(*not official*).—*Habitat*, Germany. The flowering herb contains *anemonin* or *pulsatilla camphor*. A tincture of the flowering herb, 1 to 10 of proof spirit, is also used. *Dose.*—Of the tincture, 5 to 20 minims ; anemonin $\frac{1}{60}$ to $\frac{1}{12}$ grain.

Therapeutics.—Locally, it is an irritant, and is employed in subacute inflammation of the mucous membrane, in which the discharge is of a muco-purulent character. Reputed to be diaphoretic and emmenagogue, and has been used in amenorrhœa, dysmenorrhœa, catarrh, bronchitis, and asthma.

Helleborus Niger — Black Hellebore — Christmas Rose—(*not official*).—*Habitat*, Southern and Eastern Europe.

Botany.—A herbaceous plant, with a perennial, black, rough, knotty *rhizome*, from which descend numerous root fibres; *leaves*, radial, large, stiff, deep green, pedatisected; *scape*, erect, leafless, 1 or 2 flowered; *flowers*, large, white, subsequently with a pinkish tinge. Flowering time, December to March.

Therapeutics.—The rhizome in doses of 10 to 20 grains, or an infusion of 2 drachms to 1 pint of water in doses of 1 fluid ounce have been used. Black hellebore is now seldom used in medicine. It is a drastic hydragogue, cathartic, and emmenagogue, and has been employed in mania, melancholia, epilepsy, amenorrhœa, dysmenorrhœa, chronic skin affections, and worms. In large doses it is a powerful acro-narcotic poison.

Adulteration or Substitution.—The rhizome of *Actæa spicata* is frequently confounded with black hellebore root. Actæa rhizome contains tannic acid, and strikes a black colour with a persalt of iron; hellebore contains no tannic acid and gives no such reaction.

Hydrastis Canadensis—Yellow Root—Yellow Puccoon—Orange-root—Golden Seal—(*not official*).—*Habitat*, Northern parts of North America. The rhizome with rootlets is official in the U.S. Pharmacopœia. It is about $1\frac{1}{2}$ inch long by $\frac{1}{4}$ inch thick, externally yellowish-grey, fracture short, waxy, with a bright reddish-yellow colour. A fluid extract (1 in 1) in doses of 5 to 30 minims, and a proof tincture (1 in 10) in doses of 30 to 60 minims, are in use. The rhizome contains two alkaloids, *berberine* and *hydrastine*. The *hydrastin* of the eclectics consists principally of hydrochlorate of berberine. It is given in doses of from 2 to 6 grains in pill. *Hydrastine*, which is insoluble in water, or preferably the hydrochlorate, which is soluble, is given in doses of $\frac{1}{2}$ to 6 grains.

Therapeutics.—Hydrastis is a bitter stomachic tonic, and is said to cause uterine contraction. Professor Rutherford found *hydrastin* to act as a hepatic stimulant of moderate power. It has also been used externally as an antiseptic dressing to ulcers. The pure alkaloid *hydrastine* is an antiperiodic, causing ringing in the ears like quinine. It is used in fevers, especially typhus.

Nat. Ord. **MAGNOLIACEÆ**—The Magnolia Order.—Trees or shrubs having luxuriant foliage and fragrant flowers. They inhabit chiefly North America, but are met with also in China, Japan, India, West Indies, South America, Australia, and New Zealand. The medicinal properties of the plants are chiefly bitter, tonic, and aromatic.

Official Plant.

Botanical Name.	Part Used.	Habitat.
ILLICIUM ANISATUM.	Dried fruit.	China.

ANISI STELLATI FRUCTUS—Star Anise Fruit.—The dried fruit of *Illicium anisatum*, Linn. From plants cultivated in China.

Characters.— Star anise fruit is usually composed of eight fully developed[1] carpels diverging horizontally in a stellate manner from a short central generally stalked axis. Each carpel is boat-shaped, more or less beaked, irregularly wrinkled, of a rusty-brown colour, and commonly split on its upper margin[1] so as to expose its solitary seed. Odour and taste[1] of pericarp and seed closely resembling the fruit of *Pimpinella Anisum*—European Anise.

[1] The fruits are employed in Germany, France, and Italy to flavour spirits, and their use has sometimes produced poisonous symptoms which have been traced to the presence of the fruit of a closely allied species, the *Illicium religiosum* (Siebold) or Japanese Anise. The fruits of the latter are less aromatic, and the carpels smoother, frequently not fully developed, generally closed, and more distinctly hooked at the apex.

Active Principle.—Star anise fruit contains from 4 to 5 per cent. of a volatile oil. Volatile or essential oils are ethereal liquids and generally constitute the odorous principles of plants, from which they are usually obtained by distillation with water. They usually contain a hydrocarbon called a terpene or elæopten, of which common oil of turpentine, $C_{10}H_{16}$, may be taken as the type. This usually contains, in solution, a solid oxidised terpene or stearopten, of which ordinary camphor, $C_{10}H_{16}O$, is a familiar example. Sometimes, in old samples especially, a resin, produced by further oxidation, is also present. Other volatile oils are the aldehydes of organic acids. Volatile oil of almonds, for instance, is benzoic aldehyde, HC_7H_5O, and by oxidation yields benzoic acid, $HC_7H_5O_2$. Others again are salts of organic bases. Thus volatile oil of mustard is sulphocyanate of allyl, C_3H_5CNS. Volatile oils impart an oily stain to paper, which, unlike that of a fixed oil, is not permanent, and speedily disappears when gently heated. Volatile oils can be distilled without decomposition, fixed oils cannot. Oil of star anise very closely resembles the oil of European anise (see *Pimpinella Anisum*) from which it is chemically indistinguishable. It contains a terpene and a large proportion of an oxidised terpene, *anethol* or *anise camphor*. The latter crystallises and causes the oil to solidify when the temperature is reduced. Oil of star anise solidifies at 34° F.; *Pimpinella* oil solidifies at 50° F.

Official Preparation.—Oleum Anisi. See *Pimpinella Anisum.*

DRIMYS WINTERI—Winter's Bark, Winter's Cinnamon—(*not official*).—This bark has tonic, aromatic, antiscorbutic, and stimulant properties. It has been confounded with Canella Bark, which has been called spurious Winter's Bark. It is now very rarely met with, and the so-called Winter's Bark of commerce is commonly derived from a tree a native of Jamaica, *Cinnamodendron corticosum.* It will be mentioned again in connection with Canella Bark.

Nat. Ord. **MENISPERMACEÆ**—The Moon-Seed Order.—Trailing or climbing shrubs, inhabiting the tropical forests of Asia and America, where they climb among the trees to a considerable height. The plants possess narcotic and bitter properties; some are very poisonous, and a few mucilaginous. Some are valuable tonics.

Official Plants.

Botanical Name.	Part Used.	Habitat.
JATEORHIZA CALUMBA.	Root.	East Africa.
CHONDRODENDRON TOMENTOSUM.	,,	Brazil.

JATEORHIZA CALUMBA — *Cocculus palmatus*, D.C., Calumba or Colombo.

CALUMBÆ RADIX—Calumba or Colombo Root. The dried transversely cut slices of the root of *Jateorhiza calumba*, Miers.

Characters and Test.—In irregular flattish, circular, or somewhat oval slices, from about 1 to 2 inches or more in diameter, and from $\frac{1}{8}$ to $\frac{1}{2}$ an inch or more in thickness. The cortical portion is thick, covered by a wrinkled brownish-yellow coat, and separated from the central portion, which is concave on both surfaces, by a fine dark-coloured line. The pieces have a greyish- or greenish-yellowish colour, a feeble somewhat musty odour, bitter taste, break readily with a mealy fracture, and are easily reduced to powder. A decoction, when cold, is coloured bluish-black by solution of iodine.[1]

[1] Indicating presence of starch.

Active Principles.—Calumba contains three bitter tonic substances, the alkaloid *berberine*, and *calumbin* and *calumbic acid*, glucosides. The root is loaded with starch.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Root.	$2\frac{1}{2}$ ounces from 1 pound.	2 to 10 grains.
Infusum.	"	1 in 20.	$\frac{1}{2}$ to 2 ounces.
Tinctura.	"	1 in 8.	$\frac{1}{2}$ to 2 drachms.

EXTRACTUM CALUMBÆ—EXTRACT OF CALUMBA.—*Take of calumba root, cut small,* 1 *pound; proof spirit,*[1] 4 *pints. Macerate the columba with* 2 *pints of the proof spirit for twelve hours, strain and press. Macerate again with the same quantity of proof spirit, strain and press as before. Mix and filter the liquors, recover the spirit by distillation, and evaporate the residue by the heat of a water-bath until the extract is of a suitable consistence for forming pills.*

[1] Formerly made with water, but the watery extract was very apt to become mouldy.

INFUSUM CALUMBÆ—INFUSION OF CALUMBA.—*Take of calumba root, cut small,* $\frac{1}{2}$ *ounce; cold distilled water,* 10 *fluid ounces. Macerate in a covered vessel for half an hour and strain.*

Cold water exhausts the root without dissolving the starch. The root is not to be bruised, because if it were the infusion would be muddy from suspended starch granules.

TINCTURA CALUMBÆ—TINCTURE OF CALUMBA.—*Take of calumba root, cut small,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint.*

Made by the same process as tincture of aconite.

Therapeutics.—Calumba acts as a mild, simple, bitter tonic and stomachic, neither stimulant nor astringent, but somewhat demulcent from the starch and mucilage which it contains. It improves the appetite, and aids digestion by increasing the flow of the gastric juice, and is frequently retained when other tonics would be rejected. It is given in cases of general debility, with feeble appetite, imperfect digestion, acidity, and flatulence; in convalescence from exhausting diseases; to arrest the vomiting of pregnancy, of a bilious attack, and that which arises from renal calculi, or which obstinately persists after the administration of an emetic, and in other forms of vomiting of a non-inflammatory origin. It is also given as a mild tonic in certain cases of diarrhœa, dysentery, &c. It contains no tannin and may be prescribed with iron salts. The powder is given in doses of 5 to 20 grains.

Adulterations and Substitutions.—The root of *Frasera Walteri,* American or False Calumba; the wood of *Coscinium fenestratum*, Ceylon Calumba; and the root of *Bryonia dioica*, White Bryony, have been substituted for Calumba. The first contains tannin but very little starch, and strikes a deep greenish-black with persalts of iron. The second possesses stomachic properties, and contains much berberine. It is known by its bright yellow colour, porous wood, and prominent medullary rays. The last is permanently bitter and acrid, and when stained with turmeric gives a brownish-red colour with boracic acid.

CHONDRODENDRON TOMENTOSUM.—Pareira Brava.

Pareiræ Radix—Pareira Root.—The dried root of *Chondrodendron tomentosum*, Ruiz and Pavon.

Characters and Test.—In long nearly cylindrical more or less twisted pieces, from about $\frac{3}{4}$ of an inch to 2 or more inches thick; covered with a thin blackish-brown bark, and marked externally with longitudinal furrows and transverse ridges and furrows. Internally yellowish- or brownish-grey, with well-marked concentric or more or less eccentric circles of porous wood,[1] separated into wedge-shaped portions by large medullary rays,[1] and when cut presenting a waxy appearance.[1] No odour; taste bitter. Its decoction when cold is turned inky bluish-black by solution of iodine.[1]

[1] These characters distinguish it from false pareira root.

Active Principle.—The root contains an alkaloid, *pelosine*, identical with *berberine* and *buxine*; but it seems doubtful whether its medicinal properties are due to this or some other substance not yet determined.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Root.	1 in 16.	$\frac{1}{2}$ to 2 ounces.
Extractum.	"	...	10 to 20 grains.
Extractum Liquidum.	Extract.	1 in 4.	$\frac{1}{2}$ to 2 drachms.

DECOCTUM PAREIRÆ—Decoction of Pareira.—*Take of pareira, in No.* 20 *powder*, $1\frac{1}{4}$ *ounce; distilled water*, 1 *pint. Boil for fifteen minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

This is too fine a powder. The root thinly sliced gives a much better product.

EXTRACTUM PAREIRÆ—Extract of Pareira.—*Take of pareira root, in No.* 40 *powder,* 1 *pound; boiling distilled water,* 1 *gallon, or a sufficiency. Digest the pareira with a pint of the water for twenty-four hours, then pack in a percolator, and, adding more of the water, allow the liquor slowly to pass until a gallon has been collected, or the pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for forming pills.*

EXTRACTUM PAREIRÆ LIQUIDUM—Liquid Extract of Pareira.—*Take of extract of pareira, distilled water, rectified spirit, of each a sufficiency. Dissolve four parts of the extract, in a sufficient quantity of a mixture of one fluid part of rectified spirit and three parts of water, to form sixteen fluid parts of liquid extract. Filter if necessary.*

Therapeutics.—Pareira acts as a mild tonic, and somewhat as a diuretic in moderate doses, and in larger quantity as an aperient. It is believed to act upon the genito-urinary tract of mucous membrane, operating as a gentle astringent and sedative, and modifying the quality of the urine. It was introduced into practice by Sir B. Brodie for chronic affections of the bladder, but it is not of much use; any success which he obtained with it was due to the quantity given, *i.e.*, its action as a diluent, and to the other remedies given along with it, as acids, alkalies, and opiates, according to the circumstances of the case, in fact, it merely was a vehicle, warranted by our knowledge of its active principle, which is that of a bitter tonic. It is given in chronic cystitis, and in all cases of chronic mucous and purulent discharges from the genito-urinary passages, as in catarrhal affections of the bladder, gonorrhœa, leucorrhœa, &c.; but it is chiefly valuable in correcting the mucous discharge of chronic cystitis, and for this purpose may be combined with anodynes, with alkalies, or with the mineral acids, as circumstances require.

Adulterations and Substitutions.—The stems and roots of *Cissampelos pareira* have been confounded with true Pareira Brava. It has *narrow* medullary rays and *no concentric layers* of wood. Much of the Pareira Brava of the shops is the produce of an undetermined plant. It possesses concentric or oftener eccentric zones of wood, and small medullary rays. It has not a waxy texture like the root of *Chondrodendron* but cuts as a tough, fibrous wood; and its decoction is not tinged blue by iodine. Most of it is devoid of bitterness and wholly inert.

ANAMIRTA PANICULATA—*Anamirta Cocculus, Cocculus Indicus*—(*not official*).—*Habitat,* Malabar and the Eastern Archipelago.

The *Cocculus Indicus* of commerce consists of the dried fruits.

They occur as shortly ovoid or subreniform berries, $\frac{4}{10}$ to $\frac{5}{10}$ of an inch long, with a blackish wrinkled surface, and an obscure ridge running round the back. The pericarp encloses a single reniform, bitter, and oily seed. The seeds contain a bitter, neutral, crystallizable substance, *picrotoxin*, which is the active constituent.

Therapeutics.—Cocculus Indicus acts in over-doses as an acro-narcotic poison, causing a disagreeable taste, a burning sensation in the mouth and gullet, followed by nausea, vomiting, griping pains, giddiness and staggering, resembling intoxication, tetanic convulsions, coma, and death. Its action in smaller doses has not been well ascertained. It is employed to capture fish and game, which it stupefies and destroys, and is also dishonestly added to beer to render it more bitter and intoxicating. The fish and game obtained by means of it are often eaten with impunity; but they are apt to contract the dangerous properties of the poison, especially if they die slowly, and they might transmit the fatal influence when eaten. *Cocculus Indicus* is not employed internally as a medicine. Externally, in the form of ointment, or as an ointment of picrotoxin, 10 grains to the ounce, it is used to destroy pediculi. It has also been used in scabies, in porrigo, and other chronic cutaneous diseases. If applied to a broken surface, its poisonous effects would be produced by absorption. *Picrotoxin* in doses of $\frac{1}{120}$ to $\frac{1}{15}$ of a grain has been used with good results in checking night-sweats, also employed in epilepsy and chronic alcoholism. As a poison it has no known antidote; acetic acid has been given with a measure of success. The stomach should be emptied, and the symptoms combated as they arise.

Nat. Ord. **PAPAVERACEÆ**—The Poppy Order.—Herbs with a milky juice (white or coloured), chiefly inhabitants of Europe. The medicinal properties of this order are principally narcotic; some of the plants yield an acrid juice, and some are purgative.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
PAPAVER RHŒAS.	Fresh petals.	Indigenous.
PAPAVER SOMNIFERUM.	Capsules, inspissated juice.	Britain and Asia Minor.

Papaver Rhœas.—Red Poppy, Corn Poppy, Corn Rose.

Botany.—An erect annual, 1 to 3 feet high, with a slender, branched, green, hairy stem. *Root leaves*, stalked, obovato-lanceolate, pinnatisected; *stem leaves*, sessile, amplexicaul, triangular outline, bright green, hairy on both sides. *Flowers*, solitary. *Sepals*, two, caducous. *Petals*, four, large, brilliant red, with dark purple spot at the base. *Stamens*, numerous, hypogynous, blackish-purple. *Stigmas*, ten to fourteen, sessile, forming a star-shaped process on the summit of the globular-top-shaped, one-celled, many-seeded ovary. It is a very common weed, especially in cornfields, throughout Britain.

RHŒADOS PETALA — *Red Poppy Petals.* The fresh petals of *Papaver Rhœas*, Linn. From indigenous plants.

Characters.—Of a bright scarlet colour, often nearly black at the base, unequal in size, with a strong narcotic odour, and slightly bitter taste.

Active Principles.—The petals contain about 40 per cent. of red colouring matter, reported by Leo Meier to consist of two amorphous acids called *rhœadic* and *papaveric*. This colouring matter is freely soluble in water and rectified spirit and becomes nearly black on the addition of an alkali. The colouring matters of red cabbage, rose, etc., become green when similarly treated. Attfield failed to find the slightest trace of morphine or the opium alkaloids in the petals.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Syrupus.	Fresh petals.	1 in 3½.	1 fluid drachm.

SYRUPUS RHŒADOS—SYRUP OF RED POPPY.—*Take of fresh red-poppy petals*, 13 *ounces; refined sugar*, 2¼ *pounds; distilled water*, 1 *pint, or a sufficiency; rectified spirit*, 2½ *ounces.*[1] *Add the petals gradually to the water heated in a water-bath, frequently stirring, remove the vessel and infuse for* 12 *hours. Press out the liquor, add the sugar and dissolve by heat. When nearly cold add the spirit, and sufficient distilled water to make the product weigh* 3 *pounds* 10 *ounces. Specific gravity about* 1·330.

[1] The spirit is added to prevent fermentation, which is very apt to take place in syrups containing acid vegetable juices.

Therapeutics.—The petals possess no medicinal activity, and the syrup is only used to sweeten and impart a beautiful colour to mixtures.

Papaver somniferum—Opium Poppy, White Poppy, Garden Poppy.

Botany.—Annual. *Root*, yellow and tapering. *Stem*, two to four feet high, erect, round, smooth, glaucous, branching, with a few rigid spreading hairs at the upper part. *Leaves*, amplexicaul, alternate, large, oblong, waved at the margins, lobed, glaucous. *Flowers*, large, terminal, with four large petals of a bluish-white colour, having a broad purple or violet spot at the base. *Capsule*, large, smooth, oval, or nearly globose, with parietal placentæ equal to the number of stigmas. *Seeds*, numerous, covering the placentæ, reniform, white or brownish, oily, not narcotic. *Flowering time*, June and July, the capsules ripening about two months afterwards. *Habitat*, probably south-eastern Europe and Asia Minor; but common in gardens, fields, and waste places throughout Europe, apparently wild, but probably having escaped from gardens; cultivated in Asia Minor, India, China, Persia, and Egypt for the preparation of opium; that which is cultivated in Britain being valuable only for the capsule and the oil obtained from the seeds.

Papaveris Capsulæ—Poppy Capsules.—The nearly ripe[1] dried capsules of *Papaver somniferum*, Linn. From plants cultivated in Britain.

[1] It has been proved by analysis that the *nearly ripe* capsules contain most morphine, but this direction does not appear to be always adhered to in practice.

Characters.—Globular, or somewhat oblong, from 2 to 3 inches in diameter, suddenly contracted below into a neck, and crowned above by the stellately arranged stigmas; yellowish-brown externally, and frequently dotted with blackish spots. Presenting internally a variable number of thin brittle parietal placentæ directed towards the centre of the cavity, and a very large number of loose, small, reniform, whitish, slate-coloured, or nearly black seeds. Inodorous; taste slightly bitter.

Active Principles.—The most important constituent of the capsules is the alkaloid *Morphine*, of which Merck and Winckler found 2 per cent. in the ripe fruit. They appear to contain a small proportion of the more important principles found in opium, but their composition is very variable. *Codeine*, *Narcotine*, *Papaverine*, *Papaverosine*, and *Rhœadine*, as well as *meconic*, *tartaric*, and *citric acids* have also been more or less definitely determined. The seeds possess no narcotic properties, and yield by expression about 45 per cent. of a bland, drying, fixed oil.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Capsules.	1 in 10.	...
Extractum.	Capsules freed from seeds.	About 1 from 3.	2 to 5 grains.
Syrupus.	"	About 1 to 3.	1 fluid drachm.

DECOCTUM PAPAVERIS—DECOCTION OF POPPY.—*Take of poppy capsules,*[1] *bruised,* 2 *ounces; distilled water,* $1\frac{1}{2}$ *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much water over the contents of the strainer as will make the strained product measure a pint.*

[1] The seeds are retained in this case in order to obtain the emollient effect of the fixed oil which they contain.

EXTRACTUM PAPAVERIS—EXTRACT OF POPPY.—*Take of poppy capsules, freed from the seeds, and in No.* 20 *powder,* 1 *pound; rectified spirit,* 2 *ounces;*[1] *boiling distilled water, a sufficiency. Mix the capsules with two pints of the water; infuse for twenty-four hours, stirring frequently; pack in a percolator; add more water, and allow the liquor slowly to pass until about a gallon has been collected, or until the residue is exhausted. Evaporate the liquor, by a water-bath, to a pint, and, when cold, add the spirit. Let stand for twenty-four hours, filter, and evaporate, by a water-bath, to a suitable consistence for forming pills.*

[1] The spirit is added to coagulate albuminoids which are separated by the filtration. See note on *Extractum Aconiti*, p. 161.

SYRUPUS PAPAVERIS—SYRUP OF POPPY.—*Take of poppy capsules, freed from the seeds, and in No.* 20 *powder,* 36 *ounces; rectified spirit,* 16 *fluid ounces;*[1] *refined sugar,* 4 *pounds; boiling distilled water, a sufficiency. Mix the poppy capsules with four pints of the water, and infuse for twenty-four hours, stirring frequently; then pack in a percolator, and, adding more of the water, allow the liquor slowly to pass until about* 2 *gallons have been collected, or the residue is exhausted. Evaporate the liquor by a water-bath to* 3 *pints. When quite cold add the spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to* 2 *pints, and then add the sugar. The product should weigh six pounds and a half, and should have the specific gravity* 1·330.

[1] The spirit coagulates albuminoid and mucilaginous matters which, if not removed, would very readily induce fermentation in the syrup, especially in hot weather.

Therapeutics.—Poppy capsules are anodyne, sedative, and narcotic, but vary in strength, and therefore in action. They are used instead of opium, being less powerful, and the after-effects are believed to be less disagreeable. Their action, however, is similar, and they have the disadvantage of being uncertain and the dose is larger. The decoction is employed only externally as a soothing anodyne and emollient application. It is employed as a fomentation to bruised and inflamed surfaces; to the eye in ophthalmia; to painful tumours; as an injection in painful affections of the vagina or uterus, &c. The syrup possesses the properties of opium, but it is at best an uncertain preparation. The dose will vary with the strength of the preparation and circumstances of the patient, from ½ a fluid drachm to 3 or 4 fluid drachms. A spurious syrup is not unfrequently made by adding tincture of opium to simple syrup, but it is much less palatable than the genuine syrup.

Opium—Opium—(ὀπός, the juice).—The juice obtained in Asia Minor by incision from the unripe capsules of *Papaver somniferum*, Linn., inspissated by spontaneous evaporation.

Any variety of opium may be employed as a source of alkaloids; but only that obtained in Asia Minor may be used for making other official preparations, and it must be of such a strength that when tested by the official or any trustworthy method it shall yield not less than 9·5 per cent. and not more than 10·5 per cent. of morphine. This standard, however, is too low and excludes all the best varieties of Turkey Opium. Good Smyrna opium should yield by the official test from 12 to 15 per cent. of morphine, and the official minimum should have been 12 or 13 per cent. When the percentage falls to 10 or under there is reason to suspect that the sample is adulterated.

Extraction and Collection of Opium.—The method of obtaining opium from poppy capsules, though differing in some of its details, is nearly alike in all the opium-producing countries, and is briefly as follows:—A few days after the fall, or the gathering of the petals, when the capsules are still unripe, but full of a thick milky juice, the opium collectors incise each capsule by making a transverse cut reaching almost quite round the capsule about its middle with a one-bladed knife. These incisions are made in the evening, great care being taken to prevent the blades penetrating into the interior of the capsule, whereby not only a loss of opium would accrue, but, moreover, the seeds contained within the capsule, from which a bland fixed oil is afterwards obtained, would be rendered valueless. The capsules are scarified rather than incised. During the night the milky juice exudes through the incisions, and on the following morning the collectors pass from plant to plant, scraping the tears of opium from the capsules, and carefully depositing them either upon leaves or in vessels for further manipulation. At every alternate scraping the knife is wetted with saliva by drawing it through the mouth, to prevent the adhesion of the juice to the blade. In Asia Minor, where the official opium is collected, the tears are carefully collected and placed on a poppy leaf, and when a sufficient quantity has been got to form a cake or lump, it is wrapped in poppy leaves and placed for a short time to dry in the shade. The opium is then sold by the cultivators to the merchants, by whom it is packed in cotton bags with the chaffy fruits of a species of *Rumex*, which prevent the balls sticking to one another. The bags are sealed and forwarded chiefly to Smyrna, and sometimes to Constantinople, and thence exported to Europe and America.

Characters of Official Opium from Asia Minor.—In rounded, irregularly formed, or flattened masses, varying in weight, but commonly from about 8 ounces to 2 pounds, usually covered with portions of poppy leaves, and scattered over with the reddish-brown chaffy fruits of a species of *Rumex.*[1] When fresh plastic, and internally somewhat moist, coarsely granular, and reddish or chestnut brown; but becoming harder by keeping, and darkening to blackish-brown.[2] Odour strong, peculiar, narcotic; taste nauseously bitter.

[1] Scattered *Rumex* fruits are found only on Turkey Opium.

[2] Egyptian Opium does not blacken by keeping.

Varieties of Opium.—The official *Asia Minor* or *Turkey Opium* includes two kinds, distinguished as *Smyrna* and *Constantinople* and is by far the most important commercial variety, its percentage of morphine varying from 10 to 17 per cent. Of other varieties the principal are *Egyptian Opium, Persian Opium,* and *East Indian Opium.*

Egyptian Opium.—This variety of opium is now only occasionally met with in commerce. It occurs usually in flattish or lenticular cakes about 4 inches in diameter, covered with a poppy leaf but *not strewn over with rumex-fruits.* The cakes are generally hard and dry but sometimes soft and plastic. Its colour is a dark liver-brown and it *does not blacken* by keeping. It is very inferior to *Asia Minor Opium*, the percentage of morphine varying from 3 to 6 per cent. This low percentage of morphine has been attributed by Gastinel to an over-moist soil and a too early scarification of the capsule, but it is frequently adulterated.

Persian Opium.—Persian opium occurs in various forms. The Trebizond opium of Pereira is in flattened cylindrical sticks, about

6 inches long, wrapped in smooth shiny paper, and tied with cotton. It appears to be frequently mixed with sugar and other substances, and one sample, examined by Howard, yielded only 0·2 per cent. of morphine. The most common variety, however, occurs in short rounded conical lumps and sometimes flat circular cakes covered with remnants of stalks and leaves. The conical lumps weigh from 6 to 10 ounces and are frequently quite greasy and show globules of oil when the drug is cut. This greasiness is due to the method of collection, linseed oil being applied to the blade of the knife and the fingers of the collector to prevent the juice sticking to these parts. Internally the drug is of a light-brown tint. The percentage of morphine is very variable but many recent importations have been of good quality. In the best samples Howard found 8· to 10·75 per cent. of morphine, reckoned on undried opium, and Seput found in one sample, when dried, 13·47 per cent. The presence of oil in the drug is much objected to by morphine manufacturers, its presence interfering with the separation of the alkaloid; and thereby the market value of the opium is reduced.

East Indian Opium.—This variety is remarkable for its low percentage of morphine, from 2 to 4 per cent., though some samples are met with yielding from 6 to 8 per cent. After collection the juice is kept in a semi-fluid condition for three or four weeks, during which time chemical changes take place. It is to this cause and partly to the climate that this low percentage of morphine has been attributed. It occurs in two principal forms, the *Benares Opium* in light brown spherical balls about 6 inches in diameter, weighing about 4½ pounds, and having an outer coat formed of agglutinated poppy petals; and *Malwah Opium*, an inferior variety in rectangular masses or bricks, not cased in poppy petals. East Indian opium is not an article of European commerce, the great bulk of it going to China and the remainder being used in India.

Other varieties of opium are *European Opium* and *Chinese Opium*, but they are not of sufficient importance to call for special description. The commercial and medicinal value of opium can only be determined by chemical analysis to ascertain the amount of morphine which it contains, and for determining this the British Pharmacopœia gives the following:—

Purity Test.—Take of powdered opium, dried at 212° F. (100° C.), 140 grains; lime, freshly slaked, 60 grains; chloride of ammonium, 40 grains; rectified spirit, ether, and distilled water, of each, a sufficiency. Triturate together the opium, lime, and 400 grain-measures of distilled water in a mortar until a uniform mixture results; then add 1000 grain-measures of distilled water and stir occasionally during half an hour. Filter the mixture through a plaited filter about 3 inches in diameter into a wide-mouthed bottle or stoppered flask, having the capacity of about 6 fluid ounces and marked at exactly 1040 grain-measures, until the filtrate reaches this mark.[1] To the filtered liquid (representing 100 grains of opium) add 110 grain-measures of rectified spirit and 500 grain-measures of ether; then add the chloride of ammonium, shake frequently during half an hour, and set aside for 12 hours.[2] Counterbalance two small filters,[3] place one within the other in a small funnel and decant the ethereal liquid as completely as possible upon the inner filter. Add 200 grain-measures of ether to the contents of the bottle and rotate it; again decant the ethereal layer upon the filter, and wash the latter with 100 grain-measures of ether added slowly and in portions.[4] Let the filter dry, and pour upon it the remaining liquid in the bottle in portions in such a way as to transfer the greater portion of the crystals to the filter. When the fluid has passed through, wash the bottle and transfer the remaining crystals to the filter with several small portions of distilled water, using not much more than 200 grain-measures in all,[5] and distributing the portions evenly upon the filter. Allow the filter to drain, and dry it, first by pressure between sheets of bibulous paper and finally at a temperature of 212° F. (100° C.). Weigh the crystals in the inner filter, counterbalancing by the outer filter. The crystals should weigh not less than 9·5 grains and not more than 10·5 grains, corresponding to about 10 per cent. of morphine in the dry powdered opium.

This test is a modification of the U.S.P. test and was first suggested by Conroy. In the B.P., Mr Conroy's suggestion has been further modified by reducing the quantity of opium, but this is not an advantage. [1]The object in making more than the required quantity of liquor is to save time by hastening the filtration of the necessary quantity. [2]The opium alkaloids combine with the calcium hydrate to form a soluble compound, and this is decomposed by the ammonium chloride. The morphine is precipitated as crystals in the mixture of ether, spirit, and water, in which it is only sparingly soluble, so that little is lost in the mother-liquor, in which the other constituents of the opium remain in solution. [3]This is a very convenient general method for saving time in the subsequent weighing of a precipitate. [4]It is necessary to pass the two layers of liquid through the filter separately, as the one would interfere with the passage of the other if both were placed on the filter at once.

[5]It is necessary to adhere as closely as possible to the prescribed quantities so as to avoid loss of morphia by solution. Conroy found that, operating on 100 grains of opium, rather less than one grain of morphia was lost in this way.

Composition of Opium.—Opium is an exceedingly complex substance, and is still yielding new constituents to scientific investigation. The commoner substances which constitute the great bulk of the drug are *mucilage*, *glucose*, *pectin*, *caoutchouc*, *wax*, *odorous principle*, *colouring matter*, &c. Numerous fragments of poppy capsules are also always present, and commercial *Turkey Opium* contains on an average about 12·5 per cent. of water. *Lactic acid* is said by T. and H. Smith to be a normal constituent, but it is probably a decomposition product. Opium contains neither *starch* nor *tannic acid*, both easily detected substances, the absence of which is one evidence of purity. The inorganic constituents are chiefly calcium, magnesium, and potassium salts of phosphoric and sulphuric acids, good dried opium yielding from 4 to 8 per cent. of ash.

Active Principles.—A large number of peculiar principles have been separated from opium. Up to the present time the list contains eighteen alkaloids, two neutral substances, and one organic acid. They are as follows:—

Alkaloids.

Morphine.	Narceine.	Hydrocotarnine.
Codeine.	Papaverine.	Meconidine.
Narcotine.	Rhaadine.	Cryptopine.
Pseudomorphine or Phormine.	Lanthopinæ.	Laudanosine.
Thebaine or Paramorphine.	Laudanine.	Gnoscopine.
	Codamine.	Deuteropine.
	Protopine.	

Neutral Substances.

Meconin or Opianyl and Meconosin.

Organic Acid—Meconic.

Of these the most important is *Morphine*, and it with *codeine* and *meconic acid* are alone of pharmaceutical interest. The remainder are comparatively unimportant, and the majority of them are present in opium only in very small proportion. Many of these principles yield secondary compounds of considerable chemical interest, and of these *apomorphine* is of pharmaceutical importance. We shall first consider the simple galenical preparations of the drug, and their actions and uses, and afterwards the chief of its active constituents separately.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Confectio.	Opium, dried.	1 in 40.	5 to 20 grains.
Emplastrum.	" "	1 in 10.	...
Enema.	Tincture.	1 in 33.	½ a drachm of tincture.
Extractum.	Opium, not dried.	About 1 part from 2.	½ to 1 grain.
Extractum Liquidum.	Extract, solid.	1 in 20.	10 to 40 minims.
Linimentum.	Tincture.	1 in 2.	...
*Pil. Ipecac. c̄ Scillâ.	Opium, dried.	1 in 23 nearly.	5 to 10 grains.
*Pil. Plumbi c̄ Opio.	" "	1 in 8.	3 to 5 grains.
Pilula Saponis Co.	" "	1 in 6 nearly.	3 to 5 grains.
Pulv. Cretæ Arom. c̄ Opio.	" "	1 in 40.	10 to 40 grains.
*Pulv. Ipecac. Co.	" "	1 in 10.	5 to 15 grains.
*Pulv. Kino Co.	" "	1 in 20.	5 to 20 grains.
Pulvis Co.	" "	1 in 10.	2 to 5 grains.
*Suppos. Plumbi Co.	" "	1 grain in each.	...
*Tinct. Camph. Co.	" "	2 grains in 1 ounce.	15 minims to 1 drachm.
Tinctura.	" "	33 grains in 1 ounce.	5 to 40 minims.
Tinctura Ammoniata.	" "	5 grains in 1 ounce.	½ to 1 drachm.
Trochisci.	Extract.	$\frac{1}{10}$ grain in each.	1 to 6 lozenges.
*Ung. Gallæ c̄ Opio.	Opium, dried.	32 grains to 1 ounce.	...
Vinum.	Extract.	22 grains in 1 ounce.	10 to 40 minims.

* These preparations are included here for convenience, but are fully dealt with under their respective headings elsewhere.

CONFECTIO OPII—Confection of Opium.—*Take of compound powder of opium*, 100 *grains; syrup*, 300 *grains. Mix.*

EMPLASTRUM OPII—Opium Plaster.—*Take of opium, in fine powder*, 1 *ounce; resin plaster*, 9 *ounces. Melt the resin plaster by* *means of a water-bath; then add the opium by degrees, and mix thoroughly.*

ENEMA OPII—Enema of Opium.—*Take of tincture of opium, ½ fluid drachm; mucilage of starch, 2 fluid ounces. Mix.*

EXTRACTUM OPII—Extract of Opium.—*Take of opium*[2] *(in thin slices), 1 pound; distilled water, 6 pints. Macerate the opium in two pints of the water for twenty-four hours, and express the liquor. Reduce the residue of the opium to a uniform pulp, macerate it again in two pints of the water for twenty-four hours, and express. Repeat the operation a third time.*[1] *Mix the liquors, strain through flannel, and evaporate by a water-bath until the product weighs half a pound.*

[1] This process is called triple maceration.

Test.—Analysed as described under "Opium," this extract should yield about 20 per cent. of morphine.[2]

[2] In the original issue of the 1885 Pharmacopœia powdered opium was ordered to be used, but it was pointed out by Umney that dried opium yielded from 55 to 60 per cent. of *dry* extract and consequently the official process was impracticable. He suggested that the word "powdered" should be deleted and crude opium authorised to be used, and this has been officially done. Moss, however, has found that good commercial opium yields about 60 per cent. of extract, and as the average morphine content of such opium is about 12 per cent. this extract would contain about 20 per cent. of morphine.

EXTRACTUM OPII LIQUIDUM—Liquid Extract of Opium. —*Take of extract of opium, 1 ounce; distilled water, 16 fluid ounces; rectified spirit, 4 fluid ounces. Macerate the extract of opium in the water for an hour, stirring frequently, then add the spirit, and filter. The product should measure one pint. It contains 22 grains of extract of opium, nearly, in one fluid ounce. Specific gravity from 0·985 to 0·995.*

Test.—Analysed as described under "Opium," this liquid extract should yield about 1 per cent. of morphine.

This preparation has been introduced as the official representative of *Battley's Sedative Solution.*

LINIMENTUM OPII—Liniment of Opium.—*Take of tincture of opium, liniment of soap, of each, 2 fluid ounces. Mix.*

PILULA SAPONIS COMPOSITA—Pilula Opii—Opium Pill. Lond. Dub.—*Take of opium, in powder, ½ ounce; hard soap, in powder, 2 ounces; glycerine, a sufficiency. Mix the opium and soap, and beat into a mass with the glycerine.*

PULVIS CRETÆ AROMATICUS CUM OPIO—Aromatic Powder of Chalk and Opium.—*Take of aromatic powder of chalk, 9¾ ounces; opium, in powder, ¼ ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

PULVIS OPII COMPOSITUS—Compound Powder of Opium.—*Take of opium, in powder,* 1½ *ounce; black pepper, in powder,* 2 *ounces; ginger, in powder,* 5 *ounces; caraway fruit, in powder,* 6 *ounces; tragacanth, in powder,* ½ *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

TINCTURA OPII—Tincture of Opium (Laudanum).—*Take of opium, in coarse powder,* 1½ *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient proof spirit to make one pint.*

It contains about 3·3 grains of morphine in 1 fluid ounce, which is equal to about 0·75 per cent. of morphine, or about 1¼ per cent. of bimeconate of morphine, besides the other alkaloidal salts of opium. It is usual in practice to take an equivalent weight of undried opium in slices, macerate it in the proper proportion of hot water till thoroughly disintegrated and then add the quantity of rectified spirit necessary to make the full quantity of proof spirit. By this means the preliminary drying of the opium is avoided, and it is also found that 7 days' maceration is not required, as the process may be completed in 36 hours. Some large makers estimate the morphine percentage of the tincture and bring it to the official standard by dilution with proof spirit. The official process for making tincture of opium is that known as *simple maceration*. Some manufacturers regard this as the most generally efficient and practicable process for exhausting drugs, especially when several times repeated with fresh portions of menstruum and the marc subjected each time to strong pressure. Other makers prefer the method of percolation, and use it almost exclusively.

TINCTURA OPII AMMONIATA—Ammoniated Tincture of Opium—Scotch Paregoric Elixir.—*Take of opium, in coarse powder,* 100 *grains; saffron, cut small, benzoic acid, of each,* 180 *grains; oil of anise,* 1 *fluid drachm; strong solution of ammonia,* 4 *fluid ounces;*[1] *rectified spirit,* 16 *fluid ounces.*

Made by same process as tincture of opium.

[1] The excess of ammonia holds the morphine in solution.

TROCHISCI OPII—OPIUM LOZENGES.—*Take of extract of opium, 72 grains; tincture of tolu, ½ fluid ounce; refined sugar, in powder, 16 ounces; gum acacia, in powder, 2 ounces; extract of liquorice, 6 ounce; distilled water, a sufficiency. Add the extract of opium, first softened by means of a little water, and the tincture of tolu to the extract of liquorice, heated in a water-bath. When the mixture is reduced to a proper consistence, remove it to a slab, add the sugar and gum, previously rubbed together, and mix thoroughly. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains one-tenth of a grain of extract of opium, or $\frac{1}{50}$ of a grain of morphine.*

VINUM OPII—WINE OF OPIUM.—*Take of extract of opium, 1 ounce; cinnamon bark, bruised, and cloves, bruised, of each 75 grains;*[1] *sherry wine, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation, and filter. Each fluid drachm contains about ½ a grain of morphine.*

[1] Wine of opium is now seldom used internally, but more frequently as an ingredient in eye lotions. For the latter purpose it is better to omit the cinnamon and cloves, and a preparation thus made is frequently prescribed under the title *Vinum opii sine aromatibus.*

Therapeutics.—Opium, in over-doses, acts as a powerful narcotic poison, varying in the rapidity, manner, and intensity of its effects, according to the susceptibility of the patient and the quantity and form of the drug employed. We shall briefly consider the effects of opium under the following heads:—1. Sudden or acute poisoning, or poisoning by one excessive dose. 2. Chronic or slow poisoning, opium eating and smoking. 3. Medicinal effects. 4. Peculiarities.

1. The following are the symptoms which are usually observed after an excessive dose of opium, in the case of a person not accustomed to the drug. The excitement which follows and continues for some time after a smaller dose is of short duration, and sometimes not perceptible; the patient soon becomes giddy and stupid; he is very drowsy, and craves the indulgence of sleep; when left alone, he lies motionless, and in a state of stupor, from which he can still be roused by loud appeals or shaking. But these impressions immediately pass off, and he falls again into a state of stupor, which gradually deepens, until at length he becomes utterly insensible and comatose; nevertheless, treatment is by no means to be abandoned, for by the assiduous application of galvanism and artificial respiration remarkable recoveries have occurred. During this time the *pulse* is at first small and quick,

afterwards slow and full, and at last feeble, flickering, or imperceptible; the *breathing* is at first hurried, then slow and stertorous; the *countenance* is at first placid and pale, then ghastly; the *eyelids* are closed; the *pupils* are almost always closely contracted; the *skin* is at first warm and moist, then cold and clammy; the *voluntary muscles* are relaxed and powerless; vomiting and purging sometimes occur, and occasionally convulsions precede death. The breath may have the peculiar odour of opium. The symptoms of poisoning generally make their appearance within an hour of the time at which the drug was taken, sometimes within a few minutes, but occasionally not until two or more hours have elapsed; if the stomach contains food, if the opium be taken in the solid form, or, it is also said, if the person be intoxicated at the time, the symptoms will supervene slowly, and *vice versa.* Fatal cases usually terminate in from six to twelve hours after the poison has been taken; but there are some cases in which death takes place very rapidly, and others in which the patient partially recovers, so far as to be able to converse rationally with those around him, then suffers a relapse, and dies after some days. When the patient survives twelve hours, and is restored to consciousness, there is a good prospect of his complete recovery; he then falls into a sound sleep, which may continue from twenty-four to thirty-six hours, from which he awakes to suffer the distressing after-effects, such as headache, vertigo, nausea, vomiting, loss of appetite, and general debility. It is difficult to state accurately the poisonous dose of opium or any of its compounds, as so much depends on the susceptibility of the individual, the purity of the drug, and the relative strength of the preparations; but it must be borne in mind that, whilst comparatively small doses produce but little effect in some people, and in certain diseases, and whilst some persons have recovered after taking enormous doses, on the other hand, there are cases on record in which far less than the ordinary medicinal dose has given rise to alarming symptoms. Infants and children are very susceptible of the influence of opium. A single drop of laudanum has proved fatal, and complete narcotism is very commonly the result of two or three drops of laudanum, or an equivalent of Godfrey's cordial, or other opiate nostrum, when given to infants.

2. A good deal has been written in the attempt to prove that the practice of opium-eating and of opium-smoking is not so detestable as other writers would make it appear; but the utmost that can be said in its favour is that it is not a greater vice than many others, especially spirit-drinking. In this country, the practice of opium-eating, in one form or other, is carried to a deplorable extent; and it

is but small consolation to say that it is less injurious to the health and less brutalising than dram-drinking. Both tend ultimately to destroy life; for although there are many exceptional cases of both drunkards and opium-eaters attaining the full term of years, still the rule in both is a rapid and a short career. If alcohol is more rapid in its injurious effects, opium is more sure; a man may keep alcohol in its proper place as an article of diet and as a medicine, but it is almost impossible in this climate for any person to retreat from the miserable cravings of an opium-eater. Opium-eating usually begins in the taking of medicinal doses of the drug, for the purpose of relieving a cough, allaying a pain, or checking a diarrhœa; or it is substituted by the drunkard for his quondam dram, as being a newer and more attractive stimulant; or it is resorted to by those who move in the higher circles of society, as being less easy of detection than alcoholic stimulants; or it is appealed to by the brain-worn man of letters to revive his drooping energies, or by the poet and the painter to intensify their imaginative powers. For these purposes, the object of the opium-eater is to produce and prolong the first stage of poisoning. At first small doses, as half a grain to one or two grains, will produce the desired effect; but ultimately one, two, or even three or more drachms of the crude drug will scarcely suffice to sustain its victim for a day. Under the exciting influence of opium, work, of whatever kind, is executed with the least effort; that which without such adventitious stimulus would be produced only by intense application, under the influence of opium flows almost spontaneously. But as a rule, in those who do not habitually take opium, true mental power is during all stages of its action diminished rather than increased. Even in those accustomed to its use as an aid to work, it is the imagination rather than the reasoning faculties which are excited by it. And even as an aid to genuine work, or for whatever purpose the habit may be engendered, it behoves the dabbler in opium-eating seriously to count the cost before he commits himself to a practice which he would probably never relinquish. Either by a timely resolution, therefore, supported by medical treatment if necessary, he must at once resist the craving, and flee from his adversary; or, as a confirmed opium-eater, he must deliver himself a prey to the constant and increasing demands of his inexorable taskmaster, and induce a state of mind and body which no achievements, however brilliant, can mitigate, and which no reputation, however lasting, could compensate. And, moreover, the opium-eater cannot long hide his weakness from the world ; sooner or later he is betrayed by his withered frame, his sallow countenance, and his preternaturally bright and deep-set eyes, by his bent back, his tottering gait, and his premature old age. His opium supplants his food, his appetite and digestive powers being impaired; his physical strength diminishes, and his spirits droop. When seen in the morning, before he has had his dose, he presents all the feebleness and decay, without the venerable appearance, of old age; but soon after he has swallowed his potion he freshens up wonderfully, puts on an air of active vigour, and follows his accustomed pursuits as before. This state, however, is only purchased by increasing supplies of the drug; but even the largest doses at length fail; his intellect follows the wreck of his body; and, finally, either through shame or abject misery, the wretched victim of this degrading habit either falls by his own hand or dies in hopeless impotency. There are cases, however, in which the prolonged use of opium, even in very large doses, is necessary to carry patients through the sufferings which attend their diseases; and many instances are recorded of persons having recovered under such circumstances, who neither subsequently continued the use of the drug nor felt any evil effects from the large quantity previously taken. And there are other cases in which the use of opium is continued until death, to mitigate the sufferings arising from chronic disease, without producing the demoralising effects above referred to. But such cases as these differ completely from those in which opium is employed as a source of sensual gratification.

3. As a medicine, opium has been classed with narcotics, hypnotics, anodynes, stimulants, sedatives, calmatives, diaphoretics, anti-spasmodics, anti-dysenterics, anti-hysterics, febrifuges, &c. The nature and relative extent of the several effects produced by the drug will depend chiefly upon the dose, temperament, idiosyncrasy, habit, and condition of the patient, the time of day or night at which it is taken, and the circumstances surrounding the patient. Small doses, not exceeding one grain, generally act, in persons not accustomed to the drug, as stimulants, quickening the circulation, and inducing that clear, lively, and imaginative state of mind already referred to; the face is usually flushed at this stage, the eyes preternaturally bright, and there is at first a sensation of fulness in the head. This, the first or excitement stage of opium-poisoning, is longer continued in proportion to the smallness of the dose employed to produce it, and it is this stage that the opium-eater and smoker endeavours to prolong; but whilst in him the tendency to sleep has by habitual resistance been overcome, in the case of the unaccustomed patient the soporific influence of the opium soon follows, and after a sleep, less refreshing than "Nature's sweet restorer," he awakes in a state of general dis-

comfort. When it is necessary, as for the relief of pain, or other cause, to repeat such doses, they gradually lose their power, and must be proportionately increased to produce the desired results. The action of opium upon the cerebro-spinal system is observed in the excitement and subsequent depression and stupor of moderate doses, and in the diminished sensibility, contracted pupil, loss of muscular power, and final coma of poisonous quantities ; its action upon the vascular system is observed in the variable effects produced upon the pulse, the turgidity of the countenance, and the sensation of fulness in the head ; its action upon the respiratory system is observed in the early hurried and later slow and stertorous breathing; its action upon the alimentary canal is observed in the dryness of the mouth and throat, increased thirst, diminished appetite, and constipation; in the sallow, bilious appearance of the countenance ; in the impaired powers of digestion ; and in the diminished sensibility of the stomach to the influence of emetics, but sometimes also in the production of nausea and vomiting; and it is to be remembered that some of these effects, especially constipation, are not constant to the opium-eater, as it is very common to find diarrhœa of thin serous stools accompanying the habit. Its action upon the urinary organs is observed in the commonly diminished quantity of urine, whether caused by a less secretion by the kidneys, or by retention in the bladder, and in the relief from pain produced by calculi ; its action upon the organs of generation is observed in the manifestation of the aphrodisiac properties of the drug when employed in moderation, and in the impotency which follows its abuse, both of these results, however, being probably due to the general condition of the system, rather than to any specific action upon these organs. It does not materially interfere with the functions of the uterus, nor check the secretion of milk, although it renders it narcotic. Its action upon the skin is observed in the diminished sensibility which it produces, in the increase of perspiration (the only secretion which is unequivocally increased by it), in the itchiness which is felt by some persons, and in the eruption which occasionally follows its use.

When applied externally, opium acts either topically, but its action in this respect is slight, and is thus frequently used in allaying superficial pain, or generally, by its absorption into the system. It is not likely to act upon the system, however, when merely applied to the cuticle, nor even when rubbed upon it. But when applied endermically or hypodermically, opium and its active constituents act, if not more so, at least as rapidly and powerfully as when given by the stomach.

Opium and its preparations are used for so many purposes, in so many diseases, and in combination with so many drugs, that it is quite beyond the scope of the *Note-Book* even to mention all of them. *In continued fever*, opium is frequently of great benefit in subduing nervous excitement, delirium, tremor, restlessness, and insomnia. Its administration, however, under these circumstances, demands the greatest caution and nicest discrimination to prevent dangerous results. The symptoms indicating its employment are sleeplessness, restlessness, low muttering delirium, tremor, muscular twitchings, and diarrhœa. It is contra-indicated in tendency to coma and contracted pupils. *In inflammation*, it is largely employed to allay pain, restlessness, check secretions, to operate as an antiphlogistic, alone or in combination with calomel, tartar emetic, or other drug, to act as an antispasmodic, and to check hyper-secretion. *In diseases of the nervous system*, it is employed to allay pain, as in neuralgia, to procure sleep, as in nervous watchfulness, and in some cases of delirium tremens. In the latter affection it ought never to be given in excessive doses, and its tendency to stimulate is greatly lessened by combination with tartarated antimony ; it is also employed with advantage in certain forms of insanity, such as acute mania and puerperal mania. *In convulsive and spasmodic diseases*, it has been largely used, as in epilepsy, chorea, tetanus, puerperal convulsions, hooping-cough, spasmodic asthma, colic, in all spasmodic affections of the alimentary canal, in spasmodic stricture of the urethra. *In diseases affecting the respiratory organs*, when carefully administered, it is of advantage, as in catarrh, influenza, phthisis, spasmodic asthma, and hooping-cough, besides the inflammatory affections of the respiratory organs. In some cardiac affections. *In diseases affecting the alimentary canal* it is frequently used, as in certain forms of vomiting, gastralgia, ulcer of the stomach, diarrhœa, cholera, dysentery, intussusception, strangulated hernia. *In diseases affecting the genito-urinary organs*, it is employed, as in inflammatory affections of the kidney, to allay the irritation produced by calculi in any part of the urinary canal, in inflammatory affections and irritable conditions of the bladder, and of the uterus and its appendages, and in functional derangements of these organs at the periods of menstruation, pregnancy, and delivery. *In diseases affecting the organs of locomotion*, it is used, as in rheumatism, gout, and mortification of the extremities. Besides the diseases now mentioned, opium and its preparations are given in very many others, such as cancer, hæmorrhages, chronic coughs, during the passage of calculi through the gall ducts or ureters, in diabetes mellitus, or insipidus, in hydrophobia, in ptyalism, in venereal diseases, as antidotes in poisoning by Belladonna and Stramonium, and in irritant poisoning, &c. &c. As topical applications, opiates are applied in superficial neuralgic affections, in certain irritable cutaneous diseases, in affections of the eye, ear, and throat, in toothache, in pleurodynia, rheumatic pains, &c. *Endermically*, they are frequently applied by first removing the cuticle by means of a blister, and then sprinkling the exposed surface with morphine or other preparations; and *hypodermically*, by injecting into the subcutaneous cellular tissue a solution of the officinal injectio morphinæ hypodermica, or of any other non-irritating preparation of this drug, such as the bimeconate. Enemata, suppositories, fomentations, and plasters, are other modes of local application.

4. In many of the diseases mentioned as suitable for treatment by opiates, there may be conditions in which their employment would be highly injurious, and such cases cannot always be met by general rules; there are, however, certain signs which are considered to be contra-indicative of the use of opiates, the chief of which, together with certain modifying circumstances and peculiarities in the operation of these drugs, can be but very briefly mentioned. (1) The circumstances which modify the effects of opium are divisible into those which are attributed to the patient, and others which belong to the drug. Of the former, age, sex, temperament, idiosyncrasy, habit, and condition, are the chief; *infants and children* are very susceptible of the influence of opium, and alarming symptoms are sometimes produced by the smallest doses; women are commonly more excited than men by opiates, and when unaccustomed to the drug, do not tolerate it in so large doses; nervous temperaments are sometimes soothed, but often highly excited by opiates, melancholic patients are less influenced by them, whilst those of sanguine temperament are usually most uniformly affected. By idiosyncrasy, some patients cannot take the smallest dose of opium, or any of its preparations, without suffering great discomfort, and it is essential to ascertain whether such be the case before prescribing opiates to a stranger; in these cases other drugs may be substituted; by habit persons may acquire the power of taking enormous doses without producing poisonous symptoms; some diseases, especially those attended by severe pain or spasm, increase the tolerance of opium to a considerable degree. Of the latter, the cultivation, purity, age, pharmaceutical form, and combination with other drugs, modify the effects of opiates. (2) Opiates are, as a general rule, contra-indicated under the following circumstances:—When there is a tendency to sopor or coma, and especially when the pupil is contracted; in

plethoric constituents, with congestion of the cerebral vessels; in cases of venous congestion; in pulmonary affections when the expectoration is scanty and difficult, and also in certain conditions in which there is a copious secretion from the air-passages, in kidney diseases, nursing women, and intoxicated persons. In inflammatory diseases, whilst it is given to allay pain, it must not be allowed to stupefy the patient and mask the disease. As an antiphlogistic in such cases it must be combined with other drugs of more direct action, and it is more useful in membranous than in parenchymatous inflammations.

Antidotes.—Treatment of opium-poisoning is of great importance, as it is so frequent; and as there is no reliable chemical or complete physiological antidote, prompt and careful treatment is necessary.

Indications for treatment are three in number. 1. To remove the poison from the stomach; to do this employ the stomach pump, siphon, or stimulant emetic, as mustard, salt, zinc sulphate, but not tartar emetic, as it is too depressing in its action. 2. To neutralise it chemically, but there is no reliable chemical antidote; the best is infusion of galls or tannic acid, which, however, only delay and do not prevent its absorption, hence means must be employed to obviate its injurious effects. 3. Maintain respiration by administering shocks to the patient, by shouting, flagellation, cold affusion, galvanism, keeping him walking; administer strong coffee, and inject hypodermically $\frac{1}{6}$ gr. of atropine sulphate every twenty minutes according to the urgency of the case; because these are antagonistic to the effects of opium on the nervous and respiratory systems, and as death from opium is due to paralysis of respiration, these remedies, by directly stimulating the respiratory function, are capable of warding off the result in some cases.

Adulterations.—Opium is frequently and sometimes very largely adulterated, and the only satisfactory test is the percentage of morphine. As genuine opium contains neither starch nor tannin, any indication of the presence of either points to the addition of some extraneous substance. Another test is the solubility of the sample in water, which ought to dissolve at least 55 per cent. of good dried opium. Inorganic impurities may be detected in the ash, which should not exceed 4 to 8 per cent. The natural gum of opium is precipitated by neutral acetate of lead, and any adulteration with gum arabic might be thus detected. The latter gum is not precipitated by neutral lead acetate, and if the sample is exhausted with water, treated with neutral lead acetate, filtered, and the filtrate treated with alcohol, any gum arabic present will be thrown down as a precipitate. Among the many foreign substances met with in opium are sand, pounded poppy capsules, tragacanth, gum arabic, molasses, sugar, pulp of figs or apricots, stones, bullets, shot, masses of lead, bits of clay, &c. Sometimes balls composed entirely of foreign substances, put up to resemble true opium, but containing no trace of morphine, are found in chests of otherwise good opium.

Active Principles.—By far the most important of these is the alkaloid *morphine*, which, as already stated, ought to be present in *official* opium, when dried, to the extent of not less than 9·5 and not more than 10·5 per cent. As a matter of fact, however, good *commercial* samples of Asia Minor opium yield an average of from 12 to 15 per cent., calculated on the dried opium. The alkaloid exists in the drug partly as *meconate* and partly as *sulphate*. The only other official active principles are *codeine*, the secondary alkaloid *apomorphine*, and *meconic acid*.

MORPHINÆ HYDROCHLORAS—HYDROCHLORATE OF MORPHINE—Muriate of Morphia—$C_{17}H_{19}NO_3,HCl,3H_2O$.—The details of the official process, known as Gregory's, are found by reference to the Pharmacopœia. It may be summarised as follows :—

1. Digest the opium in water, which dissolves out the meconates and sulphates of morphine and codeine.

2. Add chloride of calcium. Meconate and sulphate of lime are precipitated, and hydrochlorates of morphine and codeine remain in the solution.

3. Evaporate the whole to form a solid mass ; press strongly, reserving the dark liquid which exudes. Place upon a filter ; wash out the alkaloidal hydrochlorates ; evaporate till solid ; press strongly again and repeat the process till the salts are tolerably pure. Then dissolve in water and completely decolorise by digestion with animal charcoal. (Animal charcoal is frequently employed to decolorise alkaloids, but causes loss by absorbing considerable quantities.)

4. Filter and add ammonia in slight excess, by which means morphine is precipitated, while the codeine is held in solution in the mother-liquor.

5. Collect the crystalline morphine ; diffuse it in a little hot water, exactly neutralise with hydrochloric acid ; allow to cool ; collect the crystals of hydrochlorate of morphine and dry them on filtering paper.

6. The dark liquids from the press yield a small proportion of morphine by treating with excess of caustic potash; acidifying with hydrochloric acid; decolorising with animal charcoal; and precipitating with ammonia.

Several modifications of the official process have from time to time been suggested, in some of which the use of charcoal is avoided, and it is probable that the B.P. process is departed from in various ways by manufacturers, as the result of experience. These important private processes are, however, carefully guarded and kept secret by those interested in doing so.

Characters and Tests.—In white powder, or thin prisms of a silky lustre, not changed by exposure to the air, and soluble in 24 parts of water at common temperatures; readily soluble in spirit.[1] The aqueous solution gives a white curdy precipitate with nitrate of silver,[2] and a white one with potash,[3] which is soluble in excess of the alkali. The dry salt gives with strong nitric acid an orange-red colour, and with solution of ferric chloride a greenish-blue. Warmed with strong sulphuric and a little arseniate of sodium, a bluish-green tinge results.[4] Ignited with free access of air, it burns without leaving any residue.[5] Twenty grains of the salt dissolved in half an ounce of warm water, with ammonia added in very slight excess, gives, on cooling, a crystalline precipitate which, when washed with a little cold water, and dried on a water-bath, weighs 16 grains.[6]

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ a grain.

[1] This is incorrect. Authorities differ very much on this point. Dott found the solubility in rectified spirit to be 1 in 40 at 16° C., and this is probably the most accurate estimate, and it is therefore less readily soluble in spirit than in water. It is freely soluble in boiling spirit and insoluble in ether or chloroform. [2] Chloride of silver, indicating hydrochlorate. [3] Morphine, which is distinguished from codeine by being soluble in excess of fixed alkalis and insoluble in excess of ammonia. [4] These three colour-tests are conclusive evidence of the presence of morphine. Codeine gives no reaction with the first two and a violet-blue with the last. Pseudomorphine gives the first two reactions but not the last. There are several other colour-reactions but many of them are unreliable. Care should be taken that both the morphine salt and the reagents are as pure as possible. [5] Indicates absence of mineral impurities. [6] Equal to 80 per cent. of morphine in the salt. The theoretical yield is 80·6, but there is always a slight loss in the mother-liquor and wash water, and unless the operation be conducted with great care, the precipitate may be found to weigh a few tenths less than 16 grains.

Official Preparations.

Name.	Strength.	Dose.
Liquor.	1 per cent. by weight. 1 grain in 108 minims.	10 to 60 minims.
Suppositoria. ,, c̄ Sapone.	$\frac{1}{2}$ a grain in each.	...
Tinctura Chloroformi et Morphinæ.	1 grain in 1 fluid ounce.	5 to 10 minims.
Trochisci. ,, Morph. et Ipecac.	$\frac{1}{36}$ grain in each.	1 to 6 lozenges.

LIQUOR MORPHINÆ HYDROCHLORATIS—Solution of Hydrochlorate of Morphine.—*Take of hydrochlorate of morphine,* 9 *grains; diluted hydrochloric acid,* 8 *minims; rectified spirit,* $\frac{1}{2}$ *a fluid ounce;*[1] *distilled water,* 1$\frac{1}{2}$ *fluid ounce. Mix the hydrochloric acid, the spirit, and the water, and dissolve the hydrochlorate of morphine in the mixture.* This is stronger than the 1867 B.P. and contains about 1 grain in 108 minims. [1]The acid and rectified spirit are added as preservatives, neutral solutions of alkaloidal salts being unstable.

SUPPOSITORIA MORPHINÆ—Morphine Suppositories.—*Take of hydrochlorate of morphine,* 6 *grains; oil of theobroma,* 174 *grains. Rub the hydrochlorate of morphine with* 24 *grains of the oil of theobroma in a slightly warmed mortar,*[1] *and add this to the remainder of the oil of theobroma previously melted at a low temperature; mix the whole thoroughly and pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains ;*[2] *or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

[1] This can be better done by rubbing up on a slab with a spatula; there is thus less loss of material. The oil of theobroma should be melted in a small porcelain basin on a water-bath. [2]It is a good plan to brush the inside of the mould over with soap liniment ; the suppository is thereby prevented adhering to the mould and can be more easily removed. The mould should also be cooled by placing it on a block of ice or immersing it in cold water. Care should be taken not to pour the mass while too hot or the morphine will separate ; it should just be sufficiently fluid to run into the mould.

SUPPOSITORIA MORPHINÆ CUM SAPONE—Morphine Suppositories with Soap.—*Take of hydrochlorate of morphine,* 6 *grains; glycerine of starch,* 30 *grains; curd soap, in powder,* 100 *grains; starch, in powder, a sufficiency. Mix the hydrochlorate of morphine with the glycerine of starch and soap, and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository.*[1]

[1] These may be made by pressing the mass into the mould, previously dusted with lycopodium; allow to stand till the mass sets, and then the suppositories may be easily removed.

TINCTURA CHLOROFORMI ET MORPHINÆ—TINCTURE OF CHLOROFORM AND MORPHINE.—*Take of chloroform,* 1 *fluid ounce; ether,* 2 *fluid drachms; rectified spirit,* 1 *fluid ounce; hydrochlorate of morphine,* 8 *grains; diluted hydrocyanic acid,* ½ *fluid ounce; oil of peppermint,* 4 *minims; liquid extract of liquorice,* 1 *fluid ounce; treacle,* 1 *fluid ounce; syrup, a sufficiency. Dissolve the hydrochlorate of morphine and oil of peppermint in the spirit; add the chloroform and ether; mix the extract of liquorice and treacle with* 3 *fluid ounces of syrup; add this to the previously formed solution, mix thoroughly; add the hydrocyanic acid, and add sufficient syrup to make the product measure* 8 *fluid ounces.*

This preparation, which would have been more correctly called a mixture, has been introduced as the official representative of the well-known nostrum "chlorodyne," but it does not contain so large a proportion of morphine, and appears to be altogether a weaker preparation.

TROCHISCI MORPHINÆ—MORPHINE LOZENGES.—*Take of hydrochlorate of morphine,* 20 *grains; tincture of tolu,* ½ *fluid ounce; refined sugar, in powder,* 24 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia, a sufficiency; distilled water,* ½ *fluid ounce. Dissolve the hydrochlorate of morphine in the water; add this solution to the tincture of tolu, previously mixed with* 2 *fluid ounces of the mucilage; then add the gum and the sugar, previously mixed, and more mucilage, if necessary, to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat.*

TROCHISCI MORPHINÆ ET IPECACUANHÆ—MORPHINE AND IPECACUAN LOZENGES.—*Take of hydrochlorate of morphine,* 20 *grains; ipecacuan, in fine powder,* 60 *grains; tincture of tolu,* ½ *fluid ounce; refined sugar, in powder,* 24 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia, a sufficiency; distilled water,* ½ *fluid ounce. Proceed as in the case of Trochisci morphinæ, adding the ipecacuan along with the gum and sugar. In addition to the morphine, each lozenge contains* $\frac{1}{12}$ *grain of ipecacuan.*

MORPHINÆ ACETAS—Acetate of Morphine—($C_{17}H_{19}NO_3$, $HC_2H_3O_2$,$3H_2O$).

Preparation.—*This salt may be prepared from pure morphine obtained direct from opium as in the previous process, or the morphine may be obtained from the hydrochlorate by precipitation with ammonia. The pure morphine is diffused in water and sufficient acetic acid added to neutralise and dissolve it. Evaporate on a water-bath, keeping the acid in slight excess, till it concretes on cooling; dry with slight heat to avoid loss of acetic acid; reduce to powder; and keep in a well-stoppered bottle.*

Character and Tests.—A white powder, almost entirely soluble in 2½ parts of water;[1] readily soluble in spirit. With solution of potash, nitric acid, and ferric chloride, it gives the same reactions as the hydrochlorate. When sulphuric acid is added to the salt, acetous vapours are evolved.[2] Ignited with free access of air, it leaves no residue.[3] Twenty grains form with 1 drachm of water a slightly turbid solution, which becomes clear on the addition of 1 grain of acetic acid. This solution, treated with slight excess of ammonia, gives a precipitate which, when washed and dried, should weigh 15 grains.[4] If the salt yield a larger proportion of morphine than this, it should be recrystallised from hot water acidulated with acetic acid.[5]

[1] This applies to freshly prepared salt; commercial samples are never so soluble. [2] Indicating an acetate. [3] Indicating absence of mineral impurities. [4] Corresponding to 75 per cent. of pure morphine. The theoretical percentage is 75·93. [5] Morphine acetate is somewhat unstable and frequently contains free morphine, or it may be deficient in water of crystallisation and therefore indicates more than 75 per cent. of morphine; by the above process free alkaloid is neutralised and any deficiency of water of crystallisation made up.

Dose.—⅛ to ½ grain.

Preparations.

Name.	Strength.	Dose.
Injectio Hypodermica.	1 grain in 10 minims.	1 to 5 minims.
Liquor.	1 per cent. by weight. 1 grain in 108 minims.	10 to 60 minims.

INJECTIO MORPHINÆ HYPODERMICA — HYPODERMIC INJECTION OF MORPHINE.—*A solution of acetate of morphine containing* 1 *grain in* 10 *minims. The acetate is freshly prepared by precipitating the morphine from* 92 *grains of hydrochlorate with slight excess of ammonia; collecting and washing the precipitate; diffusing it in an ounce of distilled water, and carefully adding acetic acid to form a very slightly acid solution, which is made up to exactly* 2 *fluid ounces, by the addition of distilled water; filtered and preserved in a stoppered bottle excluded from the light to prevent decomposition.*

Characters and Tests.—A clear solution free from any solid particles. Very slightly acid to test paper. A fluid drachm, rendered slightly alkaline by the addition of ammonia, yields a precipitate which, after being washed and dried, should weigh 4·25 grains.[1]

[1] Theoretically it should weigh slightly over 4·5 grains; and some chemists erroneously make the injection by dissolving 4·25 grains of morphine in a fluid drachm of water with acetic acid. If B.P. acetate of morphine is used, the injection can be more accurately prepared by simple solution than by following the official process.

LIQUOR MORPHINÆ ACETATIS—SOLUTION OF ACETATE OF MORPHINE.—*Exactly the same as solution of the hydrochlorate, substituting acetic acid for hydrochloric.*

Morphinæ Bimeconas—Bimeconate of Morphine—($C_{17}H_{19}NO_3$, $C_7H_4O_7$).—See *Meconic Acid.*

MORPHINÆ SULPHAS—SULPHATE OF MORPHINE—($(C_{17}H_{19}NO_3)_2,H_2SO_4,5H_2O$).—*This salt is prepared by the same process as the hydrochlorate, substituting sulphuric for hydrochloric acid.*

Characters and Tests.—Colourless, silky, acicular crystals; soluble in 24 parts of water at common temperatures; sparingly soluble in rectified spirit. With solution of potash, nitric acid, and ferric chloride it gives the same reactions as the hydrochlorate. With chloride of barium it gives a white precipitate, insoluble in hot hydrochloric acid.[1] Twenty grains treated as the hydrochlorate (see p. 199) should yield a precipitate weighing 15·8 grains.[2]

[1] Indicating a sulphate. [2] Corresponding to 79 per cent. of pure morphine. The theoretical percentage is 79·94.

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

There are no official preparations of the sulphate. It is the morphine salt preferred in the United States.

MORPHINÆ HYDROBROMAS—HYDROBROMATE OF MORPHINE — ($C_{17}H_{19}NO_3,HBr,3H_2O$)—(*not official*). — Is met with in commerce as a white amorphous powder resembling the hydrochlorate.

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

MORPHINÆ MECONAS—MECONATE OF MORPHINE—($(C_{17}H_{19}NO_3)_2,C_7H_4O_7,5H_2O$)—(*not official*).—This salt occurs in white minute acicular crystals, soluble 1 in 34 of water at ordinary temperatures.

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

MORPHINÆ OLEAS — OLEATUM MORPHINÆ — OLEATE OF MORPHINE—(*not official*).—Oleic acid dissolves one-tenth of its weight of pure morphine, and a solution of 1 grain of morphine in 60 grains of oleic acid is sold under the above name.

MORPHINÆ TARTRAS—TARTRATE OF MORPHINE—($(C_{17}H_{19}NO_3)_2,H_2C_4H_4O_6,3H_2O$)—(*not official*).—This salt is met with as a white amorphous powder, like the hydrochlorate. It is soluble 1 in 10 of water, and has been recommended for hypodermic injection.

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

APOMORPHINÆ HYDROCHLORAS—HYDROCHLORATE OF APOMORPHINE—($C_{17}H_{17}NO_2,HCl$).—The hydrochlorate of an alkaloid, obtained by heating morphine or codeine in sealed tubes with hydrochloric acid.

It is convenient to consider this official morphine derivative here. The details of the process by which it may be obtained are as follows:—Put 1 *part pure morphine or codeine, and* 20 *parts pure hydrochloric acid, in a strong glass tube capable of holding at least* 15 *times the quantity; seal the open end of the tube and place it in a strong metallic tube closed with a screw cap, and place it in an oil bath, heated to between* 140° *and* 150° C., *for* 3 *hours. Allow to cool; open the tube; dilute with water; add excess of bicarbonate of sodium; decant the liquid from the precipitate, and agitate the latter with ether. To the ethereal solution add hydrochloric acid; collect the crystals of apomorphine hydrochlorate which separate; wash them with a little cold water; dry and preserve in a well closed bottle excluded from the light. Mayer has shown that by heating morphine with a solution of chloride of zinc* (*of such a strength as to have a boiling point of* 200° C.) *to* 120° C. *apomorphine is produced, and the action is completed in* 90 *minutes.*

The reaction taking place in the official process is generally explained as follows:—

$$(1)\ \underset{\text{Morphine.}}{C_{17}H_{19}NO_3} + HCl = \underset{\text{Apomorphine hydrochlorate.}}{C_{17}H_{17}NO_2HCl} + H_2O.$$

$$\text{or }(2)\ \underset{\text{Codeine.}}{C_{17}H_{17}CH_3HNO_3} + 2HCl = \underset{\text{Apomorphine hydrochlorate.}}{C_{17}H_{17}NO_2,HCl} + \underset{\text{Chloride of Methyl.}}{CH_3Cl} + H_2O.$$

The first equation is intended to explain the reaction taking place when morphine is used, and the second when codeine is used. In these equations the apomorphine appears to be produced by the process known as dehydration, that is the removal of the elements of water, and apomorphine is spoken of as morphine *minus* a molecule of water. The reaction, however, is not clearly understood. It has been ascertained that hydrochloric acid exerts a polymerising action on morphine, that is, the morphine molecules condense to form new bases such as dimorphine, the molecule of which is composed of two morphine molecules united. Wright has been led to think that the molecular weight of morphine is twice what it is usually stated to be, and gives the following equations as a probable explanation of the reaction :—

Morphine hydrochlorate.

$$C_{34}H_{38}N_2O_6,2HCl + HCl = C_{34}H_{39}ClN_2O_6,2HCl.$$

$$C_{34}H_{39}ClN_2O_6,2HCl = H_2O + C_{34}H_{37}ClN_2O_5.2HCl.$$

$$C_{34}H_{37}ClN_2O_5,2HCl + HCl = H_2O + C_{34}H_{36}Cl_2N_2O_4.2HCl.$$

Apomorphine (tetrapodimorphine) hydrochlorate.

$$2(C_{34}H_{36}Cl_2N_2O_4.2HCl) = 4HCl + C_{68}H_{68}N_4O_8.4HCl.$$

According to these equations apomorphine, or more correctly tetrapodimorphine, is produced by polymerisation and dehydration.

Characters and Tests.—Small greyish-white, shining, acicular crystals, turning green on exposure to light and air,[1] inodorous, with a very faint acid reaction on moistened litmus paper. Soluble in 7 parts[2] of water and 50 parts of alcohol, the solutions being decomposed, and turning green[1] when boiled. From solutions, bicarbonate of sodium throws down a precipitate which becomes green on standing, and then forms a purple solution with ether, violet with chloroform, and bluish-green with alcohol. With dilute solution of ferric chloride it gives a deep red,[3] and with nitric acid a blood-red coloration.[3]

[1] The green colour is due to oxidation of the apomorphine, and the reaction is so delicate as to detect 1 in 100,000 in solution. [2] This is erroneous, Dott found it to be soluble 1 in 50 of water at ordinary temperatures, and more soluble in alcohol. [3] These distinguish it from morphine, from which it differs also in apomorphine being soluble in ether.

Dose.—Expectorant, $\frac{1}{32}$ to $\frac{1}{16}$ grain; emetic, $\frac{1}{12}$ to $\frac{1}{4}$ grain, by the mouth; $\frac{1}{25}$ to $\frac{1}{6}$ grain, hypodermically.

Official Preparation.

Injectio Hypodermica, . . . 1 grain in 50 minims.
Dose.—2 to 8 minims.

INJECTIO APOMORPHINÆ HYPODERMICA—HYPODERMIC INJECTION OF APOMORPHINE.—*Take of hydrochlorate of apomorphine, 2 grains; camphor water,*[1] *100 minims. Dissolve and filter. The solution should be made as required for use.*

[1] Camphor water is used in making hypodermic solutions, because by its antiseptic properties it prevents development of fungoid growths and decomposition. It is quite useless here, but the injection may be kept clear and colourless by adding 2 minims diluted hydrochloric acid (Martindale).

CODEINA—CODEINE—METHYL-MORPHINE—($C_{18}H_{21}NO_3,H_2O$. or $C_{17}H_{19}(CH_3)HNO_3,H_2O$).—*An alkaloid obtained from opium to the extent of 0·2 to 0·4 per cent., and separated from the ammoniacal liquors from which morphine has been obtained by evaporating,*[1] *treating the residue with water, precipitating with caustic potash,*[2] *and purifying the precipitated alkaloid by recrystallisation from ether. It may also be prepared from morphine by the action of iodide of methyl and caustic soda, a process which has been patented.*

[1] To get rid of ammonia. [2] Unlike morphine, codeine is insoluble in fixed alkalies, but soluble in ammonia in which morphine is insoluble.

Characters and Tests.—In colourless or nearly colourless octahedral crystals, soluble in 80 parts of water and in solution of ammonia, readily soluble in alcohol and in diluted acids. The aqueous solution has a bitter taste and an alkaline reaction. The alkaloid dissolves in sulphuric acid, forming a colourless solution, which, when gently warmed with molybdate of ammonium or a trace of ferric chloride, assumes a deep blue colour. Moistened with nitric acid it becomes yellow, but *not red.* Ignited in air it yields no ash.

Dose.—$\frac{1}{4}$ to 2 grains.

There are no official preparations of codeine.

ACIDUM MECONICUM—MECONIC ACID—($H_3C_7HO_7$, *should be* $H_2C_7H_2O_7,3H_2O$.).—An acid obtained from opium, which contains from 3 to 4 per cent. The B.P. omits the water of crystallisation in the formula, and also represents the acid as tribasic, whereas it is now regarded as dibasic by chemists.

It may be obtained from the precipitated meconate of calcium produced in the process for extraction of morphine (see *Morphinæ hydrochloras*). *This is washed with hot water, and treated with diluted hydrochloric acid at a temperature just under* 100° C., *till dissolved. On cooling, acid meconate of calcium separates out. This is dissolved in stronger hydrochloric acid, and on cooling coloured crystals of meconic acid separate.*

These are freed from colour by neutralising with carbonate of potassium, and repeatedly crystallising the potassium meconate till it is white. It is then dissolved in hot water, and treated with excess of hydrochloric acid. Meconic acid crystallises out on cooling, and is collected, washed with cold water, and recrystallised from the smallest possible quantity of boiling water.

Characters and Tests.—In micaceous crystals, nearly colourless, sparingly soluble in water (1 in 150), readily soluble in alcohol. The solution in water has a strongly acid taste and reaction, and is coloured red by *neutral* solution of ferric chloride, the colour being discharged by strong but not by diluted hydrochloric acid, nor by perchloride of mercury.[1] The aqueous solution gives no precipitate with solution of iodine and iodide of potassium.[2]

[1] This reaction is of medico-legal importance, as meconic acid is found only in opium, and its presence points to opium poisoning. Sulpho-cyanates and acetates give a similar colour with ferric chloride, but the former is discharged by perchloride of mercury and by *strong* and the latter by *diluted* hydrochloric acid. [2] Indicating absence of alkaloids.

Official Preparation.

Liquor Morphinæ Bimeconatis, . . . $5\frac{1}{2}$ grains in 1 fluid ounce.
Dose.—5 to 40 minims.

LIQUOR MORPHINÆ BIMECONATIS — SOLUTION OF BIMECONATE OF MORPHINE.—*Take of hydrochlorate of morphine,* 9 *grains; solution of ammonia, a sufficiency; meconic acid,* 6 *grains; rectified spirit,* $\frac{1}{2}$ *fluid ounce; distilled water, a sufficiency. Dissolve the hydrochlorate of morphine in* 3 *drachms of distilled water by gentle heat; add ammonia in slight excess; cool; filter; wash the precipitate with distilled water until the washings cease to give a precipitate with nitrate of silver;*[1] *drain; mix the precipitate with sufficient water to produce* $1\frac{1}{2}$ *ounce; add the rectified spirit and meconic acid, and dissolve.*[2]

[1] Indicating absence of chlorides. [2] Should the liquor require filtration, care must be taken that the filter paper does not contain iron, otherwise the solution will be coloured red. Dott has shown that though the existence of morphine bimeconate is *theoretically possible*, its existence has never been *proved*, and he adduces reasons for regarding this liquor as a solution of neutral meconate with excess of meconic acid.

Characters and Tests.—A colourless or nearly colourless liquid. Solution of potash and nitric acid give the reactions of morphine, and ferric chloride the reactions of meconic acid. The solution is about the same strength as Tincture of Opium as regards morphine meconate.

Dose.—5 to 40 minims.

Of the non-official *active principles,* only four appear to be of medicinal importance. These are as follows:—

NARCEINA — NARCEINE — ($C_{23}H_{29}NO_9$) — (*not official*). — An alkaloid having feeble basic properties. Opium contains a proportion varying from ·02 to 0·7 per cent. It occurs in light white flexible silky crystals, sparingly soluble in water (1 in 400), freely soluble in alcohol, insoluble in ether.

Dose.—$\frac{1}{2}$ to 1 grain.

NARCOTINA — NARCOTINE—($C_{22}H_{23}NO_7$)—(*not official*).—This alkaloid, which is also feebly basic, occurs in white, inodorous, crystalline prisms. Opiums contain a proportion varying from 2 to 10 per cent. It is insoluble in water, and sparingly soluble in alcohol (1 in 100) and ether (1 in 125).

Dose.—1 to 3 grains.

PAPAVERINA—PAPAVERINE—($C_{21}H_{21}NO_4$)—(*not official*).—A very feebly basic alkaloid, present in opium to the extent of 1 per cent. It is met with in colourless acicular crystals, like morphine sulphate. It is insoluble in water, sparingly soluble in alcohol, and soluble in ether.

Dose.—$\frac{1}{12}$ to $\frac{1}{3}$ grain.

THEBAINA OR PARAMORPHINA—THEBAINE OR PARAMORPHINE—($C_{19}H_{21}NO_3$)—(*not official*).—T. and H. Smith found 0·15 per cent. in Turkey Opium. The alkaloid forms white crystalline needles, soluble in water, alcohol, and ether. It is interesting from the fact that in 1 grain doses it produces tetanic spasms.

Therapeutics of Active Principles.—*Morphine* possesses the anodyne and soporific powers of opium, but is less stimulating, less constipating, less diaphoretic, and less liable to produce headache and nausea. *Apomorphine* acts promptly as a powerful emetic, producing comparatively little nausea or depression. It is especially valuable in cases where an emetic cannot be administered by the mouth. Small doses are expectorant. *Codeine* in moderate doses is hypnotic. In small doses it is useful in chronic laryngitis, and when frequently repeated it allays cough in phthisis. In doses of 1 grain, gradually increased to 2 grains, thrice daily, it reduces the amount of sugar in the urine in diabetes, but the patient must rigidly abstain from starchy food. It may be administered in the form of pills, syrup, or lozenges. *Narceine* acts as a soporific, and is said to produce no constipation, and less headache and perspiration than morphine. *Narcotine* possesses antiperiodic properties, and is regarded by some as superior to quinine in ague. *Papaverine* is strongly narcotic, not producing previous excitement, or being followed by headache and giddiness. It contracts the pupil, and, when it produces sleep, reduces the frequency of the pulse from 20 to 30 beats. A recent research by Dott and Stockman indicates that the opium alkaloids form a group possessing similar properties but differing in intensity.

Argemone Mexicana—Mexican or Gamboge Thistle—Prickly Poppy—(*not official*).—*Habitat*, America, Africa, Asia. The plant abounds in an acrid yellow juice. The small round, black, roughish seeds yield, by expression, a light yellow, limpid, drying fixed oil, having a somewhat nauseous odour, and a slightly acrid taste.

Dose.—Of the *seeds*, as an emetic, 2 drachms, infused in a pint of water; of the *oil*, as a cathartic, 15 to 20 drops.

Therapeutics.—The plant is emetic and purgative, and possesses also narcotic properties. The juice has been used internally in obstinate cutaneous eruptions, and as a local application to warts and chancres, and in diseases of the eyes. The seeds have been used as a substitute for ipecacuanha in the West Indies. The expressed oil possesses aperient properties, and has been recommended as a remedy in cholera. It has also been found useful in flatulent colic, and in colic with constipation. In Upper India it is successfully used as a local application in the *dahd*, a troublesome cutaneous affection of the waist.

Chelidonium majus—Common Celandine—(*not official*).—*Habitat*, Britain. A common weed on roadsides and waste places, chiefly near houses; readily known by its small, yellow, cruciate flowers, and by the yellow fœtid juice in which the plant abounds. The plant is said to contain *chelidonic acid*, *chelerythrine*, an alkaloid, *chelidonin*, a glucoside, and *chelidoxanthin*, a yellow neutral principle.

Dose.—Of the dried herb, 30 to 60 grains; of the watery extract, 5 to 10 grains; of the expressed juice, 10 to 20 drops.

Therapeutics.—Celandine is an acrid purgative, possessing also diuretic, diaphoretic, and expectorant properties. It has been used as a remedy in jaundice, and also in some scrofulous complaints affecting the mesenteric and lymphatic glands, the skin, and the eyes. The yellow juice is a popular external application to corns and warts, and has been successfully used in eczema, urticaria, and opacities of the cornea. *Chelerythrine* appears to be an acrid narcotic poison.

Sanguinaria Canadensis—Blood Root—Red Root—Puccoon—

Indian Paint—(*not official*).—*Habitat*, North America. The rhizome is official in the U.S.P. It occurs in commerce, in pieces from 1 to 2 or 3 inches in length, frequently branched, and with or without slender red rootlets. Colour, externally, dark reddish-brown. It contains an alkaloid, *sanguinarine*, said to be identical with the *chelerythrine* of celandine, to which it owes its properties. It also contains *porphyroxin*, *puccin*, and *sanguinarinic acid*. The rhizome is said to deteriorate rapidly by keeping. A tincture is official in the U.S.P. The eclectic remedy, *sanguinarin*, is a coffee-brown coloured resinoid, obtained from the rhizome.

Dose.—Of the powdered rhizome as a sedative, 1 grain; as a diaphoretic, 1 to 15 grains; as an emetic, 10 to 20 grains: of the tincture, as an alterative and expectorant, 30 to 60 minims; as an emetic, 1 to 4 drachms. *Sanguinarin*, $\frac{1}{4}$ to 1 grain in pill.

Therapeutics.—Sanguinaria is emetic and purgative in large doses; stimulant, expectorant, and diaphoretic in small doses. Said to possess escharotic properties when applied externally, and has been recommended for cancerous growths, but its value has been disproved on trial. *Sanguinarin* is, in small doses, stimulant and tonic; in larger doses, sedative, reducing the pulse, and increasing expectoration; in still larger doses, emetic. It has been shown to be a decided and powerful cholagogue, undoubtedly emmenagogue, and useful in functional amenorrhœa, dyspepsia, and gastro-intestinal catarrh.

Nat. Ord. **CRUCIFERÆ or BRASSICACEÆ**—Cruciferous or Cabbage Order.—Herbaceous, or very rarely shrubby plants, widely distributed, but abounding in cold, temperate climates, especially in Europe. The order contains many useful culinary vegetables, but not one poisonous plant. The plants generally possess acrid, pungent, and antiscorbutic properties.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
BRASSICA ALBA.	Seeds.	Britain.
BRASSICA NIGRA.	"	"
COCHLEARIA ARMORACIA.	Fresh root.	"

Brassica alba—Mustard Brassica—Cultivated Mustard—White Mustard.

Botany.—An erect annual. *Stem*, 1 to 2 feet high, glabrous, or with spreading stiff hairs. *Leaves*, pinnately lobed, more or less rough, lobes ovate or oblong, coarsely toothed, the terminal one largest. *Flowers*, rather large, yellow, fruit pedicels *spreading*. *Pod*, $\frac{3}{4}$ to 1 inch long, more than one half occupied by a stout flattened beak, often curved, with a single seed in its base, the valves and lower part of the beak very hispid, with stiff white hairs concealing the prominent nerves. *Flowering time*, all summer.

Brassica nigra—Black Brassica—Black Mustard.

Botany.—A large branching annual, sometimes entirely glabrous, especially in the upper part, but the lower leaves and stem are generally slightly hispid. *Stem*, 2 to 4 feet high. *Leaves*, mostly deeply divided, with one large terminal or oblong lobe, and a few small lateral ones, the upper leaves often small and entire. *Flowers*, bright yellow, rather smaller than those of *B. alba*. *Pods*, on short pedicels, *closely pressed against* the axis of the long slender raceme, glabrous, seldom more than half an inch long, with a slender style, slightly conical at the base, the valves marked with a strong midrib. *Flowering time*, summer.

SINAPIS ALBÆ SEMINA—White Mustard Seeds.—The dried ripe seeds of *Brassica alba*, Hook. fil. and Thomp. (*Sinapis alba*, Linn.). From plants cultivated in Britain.

Characters.—About $\frac{1}{12}$ inch in diameter, roundish, pale yellow, very finely pitted, hard; internally, yellow, oily. Inodorous; taste, pungent.

SINAPIS NIGRÆ SEMINA—Black Mustard Seeds.—The dried ripe seeds of *Brassica nigra*, Koch. (*Sinapis nigra*, Linn.). From plants cultivated in Britain.

Characters.—Scarcely half the size of white mustard seeds, roundish, dark reddish or greyish-brown, finely pitted, hard; internally, yellow. Inodorous when dry, even when powdered, but when triturated with water, exhaling a strong pungent odour, so as to affect the eyes; taste, very pungent.

Active Principles.—*White mustard seeds* contain from 20 to 23 per cent. of a non-drying *fixed oil*, *sinalbin*, $C_{30}H_{44}N_2S_2O_{16}$, a colourless crystalline neutral principle, playing the part of a glucoside, like the *amygdaline* of bitter almonds, and *myrosin*, an albumenoid ferment like *emulsin* (see *Amygdala amara*). Under the influence of *myrosin*, in presence of water, *sinalbin* splits up into *sulphocyanate of acrinyl*, acid sulphate of the alkaloid *sinapine*, and glucose. *Sulphocyanate of acrinyl* is the rubefacient and vesicating principle which gives the pungency to white mustard seeds when mixed with water. It does not pre-exist in the seed, is not volatile, and therefore cannot be obtained by distillation. *Black mustard seeds* contain the same constituents as white, with the exception of *sinalbin*, which is replaced by the analogous body *sinigrin*. In presence of myrosin and water, *sinigrin*, or myronate of potassium, $C_{10}H_{18}KNS_2O_{10}$, yields 0·4 to 0·6 per cent. of sulphocyanate of allyl (essential oil of mustard), C_3H_5CNS, acid sulphate of potassium, $KHSO_4$, and glucose, thus:—

$$\underset{\text{Sinigrin.}}{KC_{10}H_{18}NS_2O_{10}} = \underset{\substack{\text{Acid sulphate}\\\text{of potassium.}}}{KHSO_4} + \underset{\substack{\text{Sulphocyanate}\\\text{of allyl.}}}{C_3H_5CNS} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

Sulphocyanate of Allyl is a volatile oil, intensely pungent, and almost instantly blistering when applied to the skin. Like sulphocyanate of acrinyl, it does not pre-exist in the seed, and hence the pungency is only developed after water has been added. Unlike the latter, it is volatile, and can therefore be obtained by distillation. Mustard seeds also contain about 19 per cent. of gum, and when ignited, yield 4 per cent. of ash. They contain no starch when ripe.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Sinapis.	Powdered black and white seeds mixed.	...	1 to 4 drachms in water as an emetic.
Cataplasma.	"	About 1 in $6\frac{1}{2}$.	
Charta.	"	...	
Linimentum Co:	Essential oil.	About 1 in $37\frac{1}{2}$.	
Oleum.	Black seeds after expression of fixed oil.	...	

SINAPIS—Mustard.—Black and white mustard seeds, powdered and mixed, usually in the proportion of 2 parts of the former to 3 parts of the latter.

Characters.—Greenish-yellow, of an acrid, bitterish, oily, pungent taste, scentless when dry, but exhaling, when moist, a pungent, penetrating, peculiar odour, very irritating to the nostrils and eyes. A decoction cooled is not made blue by tincture of iodine.[1]

[1] Indicating absence of starch. Only ripe seeds are official. Unripe seeds contain starch.

CATAPLASMA SINAPIS — Mustard Poultice. — *Take of mustard, in powder, $2\frac{1}{2}$ ounces; linseed meal, $2\frac{1}{2}$ ounces; boiling water, and water, of each a sufficiency. Mix the mustard with 2 or 3 ounces* *of lukewarm water;*[1] *mix the linseed meal with* 6 *or* 8 *ounces of boiling water; add the former to the latter, and stir them together.*

The lukewarm water should not exceed a temperature of 122° F. (50° C.).

[1] The *myrosin* is coagulated by boiling water, and rendered incapable of producing the pungent principles *sulphocyanate of acrinyl* and *oil of mustard.* Hence the necessity for using lukewarm water.

CHARTA SINAPIS—Mustard Paper.—*Take of mustard, in powder,* 1 *ounce;*[1] *solution of gutta percha,* 2 *fluid ounces, or a sufficiency. Mix the mustard with the gutta percha solution so as to form a semifluid mixture, and having poured this into a shallow flat-bottomed vessel, such as a dinner plate, pass strips of cartridge-paper over its surface so that one side of the paper shall receive a thin coating of the mixture. Then lay the paper on a table with the coated side upwards, and let it remain exposed to the air till the coating has hardened. Before applying to the skin, immerse the mustard paper for a few seconds in tepid water.*[2]

[1] In the U.S.P. the fixed oil is removed by washing the mustard with benzol. This obviates the untidy greasiness, and prevents the plaster adhering to the skin. [2] To develop the volatile oil.

OLEUM SINAPIS—Oil of Mustard.—The volatile oil distilled with water from black mustard seeds after expression of the fixed oil. The seeds yield from ·2 to ·5 per cent.

Characters.—Colourless or pale yellow. Specific gravity, 1·015 to 1·020. Boiling point about 298° F. (147°·8 C.). Dissolves readily in alcohol and ether, and to a slight extent in water. Has an intensely penetrating odour, and a very acrid, burning taste. Applied to the skin, it produces almost instant vesication.

LINIMENTUM SINAPIS COMPOSITUM—Compound Liniment of Mustard.—*Take of oil of mustard,* 1 *fluid drachm; ethereal extract of mezereon,* 40 *grains; camphor,* 120 *grains; castor oil,* 5 *fluid drachms; rectified spirit,* 4 *fluid ounces. Dissolve the extract of mezereon and camphor in the spirit, and add the oil of mustard and castor oil.*

Therapeutics.—Mustard is largely used as a condiment, and as such promotes digestion by exciting the secretion of gastric juice. It also acts as a stimulant, quickening the circulation, and, when continued, increasing the secretions of the skin and kidneys. In larger doses (one or two tea-spoonfuls in a tumblerful of warm water) it acts as a stimulating emetic, producing but little subsequent depression. Externally it acts as an irritant, rubefacient, and vesicant, and will readily produce more serious effects if carelessly applied; hence when a mustard poultice is applied to a patient who is insensible, and in young children and delicate persons, it is important to watch its effects from time to time, and above all, not to *forget it.* As an emetic it is useful in narcotic poisoning, and in other lethargic, debilitated, and congested conditions, in which it is of importance to empty the stomach and arouse the vital powers promptly, without causing subsequent depression. White mustard seeds are largely used as a popular emmenagogue. Topically, mustard is of great use as a counter-irritant and derivative and stimulant cataplasm in a vast number of cases. Mustard is sometimes added with advantage to a warm bath in the case of children with retrocedent skin eruptions, or suffering from severe bronchitis. A mustard sitz-bath is also frequently beneficial in amenorrhœa, while mustard pediluvia are found useful in alleviating headache, diminishing congestion of the head, and lessening inflammation of internal organs. The liniment is vesicating and stimulating, and is used, either alone or diluted with an equal bulk of olive oil or glycerine, to rub over scrofulous glands, over the chest in pleurodynia, for cases of lumbago and sciatica, and in chronic sprains. The objections to its use are, that it is both expensive and liable to deteriorate on keeping through escape of the volatile oil.

Adulterations.—The powdered seeds are frequently mixed with farinaceous substances, such as wheaten flour. This is readily detected by the iodine test. Turmeric is added to heighten the colour. It is detected by striking a red-brown colour with solution of boracic acid. Capsicum is also added to increase the pungency. It may be detected by treating the powder with a little rectified spirit, to which the capsicum imparts its pungency. The volatile oil sometimes contains alcohol or bisulphide of carbon. These are detected by the specific gravity and boiling point. The seeds of *Brassica juncea* take the place of black mustard in India. They closely resemble the latter, and are now imported into Europe.

Cochlearia Armoracia—Horse-Radish.

Botany.—Perennial. *Stem*, erect, round, branched, about 2 feet in height. Radical *leaves*, large, oblong, crenate, dark green; those of the stem smaller, sessile, lanceolate. *Flowers*, numerous, white, racemose. *Flowering time*, May.

ARMORACIÆ RADIX — *Horse-Radish Root.*—The fresh root of *Cochlearia Armoracia*, Linn. From plants cultivated in Britain. Most active in the autumn and early spring before the leaves have appeared.

The root may be kept fresh for some time, if buried in sand in a cool place.

Characters.—Nearly cylindrical, except at the upper end, where it is enlarged and conical, and marked in an annulated manner by the scars of fallen leaves. It is from half an inch to about an inch in diameter, and commonly a foot or more in length; pale yellowish-white or brownish-white externally, whitish and fleshy within.[1] Taste very pungent, but inodorous, except when scraped or bruised, when it exhales a characteristic pungent odour.[2]

[1] See note on aconite root. [2] See *Lauro-cerasus.*

Active Principles.—Similar to those of black mustard seeds, namely, *myrosin* and *sinigrin*, which in presence of water produce a *volatile oil*, identical with volatile oil of mustard. The root cannot be dried without injuring its active principles. It yields about ·05 per cent. of *volatile oil.*

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Spiritus Compositus.	Fresh root.	1 in 8.	1 to 2 drachms.

SPIRITUS ARMORACIÆ COMPOSITUS — COMPOUND SPIRIT OF HORSE-RADISH.—*Take of horse-radish, scraped, bitter-orange peel, cut small and bruised, of each* 20 *ounces; nutmeg, bruised,* ½ *ounce; proof spirit,*[1] 1 *gallon; water,* 3 *pints. Mix and distil a gallon.*

Test.—Specific gravity about 0·920.

[1] Dilute spirit is used because stronger spirit would coagulate the *myrosin*, and consequently prevent formation of the *volatile oil.*

Therapeutics.—Horse-radish acts like mustard, but is little used in medicine. It is used as a condiment, and promotes digestion. The compound spirit has been chiefly employed as a diuretic in dropsies.

Nat. Ord. **CANELLACEÆ.**—The genus *Canella* has been placed by Martius in a separate order; some botanists have placed it in the *Guttiferæ*, others in the *Meliacæ.*

Official Plant.

Botanical Name.	Part Used.	Habitat.
CANELLA ALBA.	Dried bark.	Bahama Islands.

CANELLÆ CORTEX—Wild Cinnamon — Spurious Winter's Bark.—The bark of *Canella alba*, Murray, deprived of its corky layer and dried.

Characters.—In quills or irregular pieces, which are generally more or less twisted and broken longitudinally; it has a pale orange-brown or buff colour externally; is commonly marked by rounded depressions or scars, and sometimes the remains of the corky layer may be seen here and there as silvery grey patches; internally, its colour is pale, being white or yellowish-white; it has an agreeable odour, somewhat resembling a mixture of cloves and cinnamon, and a pungent bitter acid taste.

Active Principles.—A *volatile oil*, of which it yields from 0·7 to 0·9 per cent.; 8 per cent. of *mannite* (the so-called *Canellin*), and a *bitter principle* which has not been isolated.

Official Preparation.

Vinum Rhei, ... 60 grains to 1 pint.

Therapeutics.—Canella acts as an aromatic stimulant and tonic. It is seldom used alone, but generally as an adjunct to other tonics, or as a corrigent to resinous purgatives. It is used as a condiment in the West Indies. The powdered bark may be given in doses of 10 to 30 grains. *Hiera Picra* consists of aloes (4) and canella (1).

Adulterations or Substitutions.—Canella bark is sometimes confounded with true *Winter's Bark*, obtained from *Drimys Winteri*, Forster; and also with the bark of *Cinnamodendron corticosum*, Miers, which is commonly sold as *Winter's Bark* in this country. Both these barks, however, contain *tannic acid*, and an infusion of either is blackened by a persalt of iron. Canella bark *contains no tannic acid*, and consequently its infusion is not blackened when similarly treated.

VIOLACEÆ—The Violet Order—(*not official*).—The plants of this order possess expectorant, emetic, and purgative properties, which are probably due to the presence of *violina*, an alkaloid resembling emetina. The only one of pharmaceutical interest is the *Viola odorata*—the Marsh or Sweet Violet. From the flowers a syrup is prepared, which is employed to give colour and flavour to other medicines, and also, along with almond oil, as a laxative for young children; the root and seeds are emetic and purgative. *Ionidium Ipecacuanha*, the root of which has been sometimes erroneously substituted for true *Ipecacuanha*, belongs to this order.

Nat. Ord. **BIXACEÆ**—The Annatto Order—(*not official*).—*Gyno-*

cardiæ Semina, the seeds of *Gynocardia odorata*, R., are official in the Pharmacopœia of India, and are known under the names of *Chaulmugra*, *Chaulmogra*, or *Chaulmoogra*. They yield by expression 51·5 per cent. of a fatty oil (*Oleum Gynocardiæ*), having a characteristic odour, and solid at ordinary temperatures in this country. A fatty acid, *Gynocardic Acid*, is said to be the active constituent of the oil.

Dose.—Seeds, 6 grains; oil, 5 or 6 drops; *gynocardic acid*, ½ to 3 grains *after meals*.

UNGUENTUM GYNOCARDIÆ—CHAULMOOGRA OINTMENT.—*Take of chaulmoogra oil*, 1 *part*; *soft paraffin*, 2 *parts*; *hard paraffin*, 1 *part*. *Melt and stir till cold.*

Therupeutics.—The seeds are alterative tonic in small doses, and emetic in large doses. The oil and *gynocardic acid* are applied externally, and given internally for leprosy, phthisis, scrofula, marasmus, psoriasis, and lupus. Also applied with gentle friction for chronic rheumatism and rheumatic gout. The ointment has been found useful in obstinate eczema, with thickening of the skin.

Nat. Ord. **POLYGALACEÆ**—Milkwort Order.—Herbs or shrubs widely scattered over the world. The plants are generally bitter and acrid, and have milky roots. Medicinally, they are expectorant, sudorific, diuretic, purgative, tonic, and astringent.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
POLYGALA SENEGA.	Dried root.	North America.
KRAMERIA TRIANDRA.	"	Peru and Bolivia.
KRAMERIA IXINA.	"	New Granada, British Guiana, and Brazil.

Polygala Senega—Senega or Seneka Root—Rattlesnake Milkwort—Senega Snake Root.

Senegæ Radix.—The dried root of *Polygala Senega*, Linn.

Characters.—Enlarged at the upper end into an irregular knobby tuberosity, which bears the remains of numerous small stems, and tapering below into a more or less twisted or curved, branched, and usually keeled root,[1] from one-fifth to more than a third of an inch thick. Bark, yellowish- or brownish-grey, transversely cracked, horny, translucent; enclosing an irregular, whitish, central, woody column.[2] Fracture, short, brittle; odour of bark, peculiar, rancid and its taste at first sweetish, but afterwards very acrid, sourish, and causing a flow of saliva; wood, tasteless and inodorous.[3]

[1] This distinguishes it from the roots of *Polygala Boykinii*, and other roots which have no keel. [2] Other varieties of Senega root have a *regular cylindrical* central woody column. [3] The active principle is found only in the cortical section.

Active Principles.—Senega root yields about 2 per cent. of a glucosidal substance called *Senegin*. Kobert reports that the root contains an acid glucoside, *polygalic acid*, and a neutral glucoside, *senegin*, which closely resemble the *quillaic acid* and *sapotoxin* of quillaia bark chemically, but are less active physiologically. It also contains a *fixed oil* and a little *volatile oil*. The rootlets appear to contain most *senegin*.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Dried root.	1 in 20	1 to 2 ounces.
Tinctura.	"	1 in 8	½ to 2 drachms.

INFUSUM SENEGÆ—INFUSION OF SENEGA.—*Take of senega root, in No. 20 powder, ½ ounce; boiling distilled water, 10 fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

On standing, infusion of senega, and especially the concentrated (1 to 7) infusion, throws down a whitish deposit. This appears to consist of *sapogenin*, formed by the gradual splitting up of the *senegin* into *sapogenin* and glucose. A similar change probably takes place in the tincture, but it is attended by little or no deposit, as the *sapogenin* formed is soluble in the menstruum.

TINCTURA SENEGÆ—TINCTURE OF SENEGA.—*Take of senega root, in No. 40 powder, 2½ ounces; proof spirit, 1 pint.* Made by the same process as tincture of aconite.

Therapeutics.—Senega acts as a stimulating expectorant. Of all the therapeutic actions attributed to senega, the expectorant is the only one of which there is reliable proof. In larger doses it operates as an emetic or purgative, and is apt to produce troublesome salivation. It is chiefly used in chronic bronchial and pulmonary inflammations, especially in old people with copious secretion, in cases which require stimulation rather than depletion. It may be combined with ammonia, squill, &c., or, in more acute cases, with tartar emetic. Tincture of Senega is frequently employed to emulsify oils, resins, &c., a property which is due to the *senegin* it contains.

Substitutions and Adulterations.—Senega root does not appear to be intentionally adulterated, but it is not uncommon to find other roots accidentally mixed with it. Of these the most common is the root of *Panax quinquefolium*, Linn., American Ginseng root; it is easily distinguished by being fusiform, much thicker than senega, and having no keel. The roots of *Gillenia trifoliata, Cypripedium pubescens*, and *Cynanchum Vincetoxicum* have also been observed, but they are not keeled, do not resemble the true root, and can readily be detected. The roots of *Polygala Boykinii* and the roots of the northern variety of true senega, *Polygala Senega* var. *latifolia*, and others are frequently substituted for the official root. Much of the senega root of commerce consists of the northern variety. These varieties all contain the active constituents of senega, but in less proportion than the true root.

Krameria triandra—Krameria—Peruvian Rhatany.

Krameria Ixina, var. Granatensis—Krameria—Savanilla or New Granada Rhatany.

KRAMERIÆ RADIX — Rhatany Root. — The dried root of (1) Peruvian Rhatany, *Krameria triandra*, Ruiz and Pavon; or of (2) Savanilla Rhatany, *Krameria Ixina*, Linn.

Characters.—1. Peruvian Rhatany is in branched or unbranched pieces, varying in length and thickness. It consists of a readily separable bark, which varies in thickness from about $\frac{1}{20}$ to $\frac{1}{10}$ of an inch, rough and scaly except in the smaller pieces, dark reddish-brown externally, and bright reddish-brown on its inner surface, and with a hard brownish or reddish-yellow woody axis. 2. Savanilla Rhatany is less irregular and knotty, and not so long or thick as the former. It is well characterised by its dark purplish or violet colour, and its smooth and thicker bark which adheres firmly to the wood beneath, and is usually marked at irregular intervals by deep transverse cracks. The bark of both kinds has a strongly astringent taste, and when chewed tinges the saliva red, but it has no marked odour. The wood is nearly tasteless and inodorous.

Active Principles.—Rhatany root owes its properties to *rhatania-tannic* or *krameria-tannic acid*, of which it yields about 20 per cent. This acid closely resembles *catechu-tannic* and *cincho-tannic acids*, and, like the latter, yields by oxidation a substance like *cinchona-red* called *rhatania-red* which is also found in the root. These substances are confined to the bark, the wood being inert. The proportion of bark to wood is greater in the Savanilla than the Peruvian variety, and consequently the former is to be preferred for medicinal use. The *tannic acid* in the two roots appears to differ slightly, If a section of Peruvian Rhatany is moistened with ferrous sulphate solution it becomes greyish ; Savanilla Rhatany, when similarly treated, assumes an intense violet colour.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Dried root.	...	5 to 20 grains.
Infusum.	"	1 in 20	1 to 2 ounces.
Tinctura.	"	1 in 8	½ to 2 drachms.

EXTRACTUM KRAMERIÆ—EXTRACT OF RHATANY.—*Take of rhatany root, in No.* 40 *powder*, 1 *pound* ; *distilled water a sufficiency. Macerate the rhatany in a pint and a half of the water for twenty-four hours; then pack in a percolator, and add more distilled water, until twelve pints have been collected, or the rhatany is exhausted. Evaporate the liquor by a water-bath to dryness.*

This is an example of the class of preparations known as dry extracts.

INFUSUM KRAMERIÆ—INFUSION OF RHATANY.—*Take of rhatany root, in No.* 40 *powder*, ½ *ounce ; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

The above degree of comminution is needlessly fine, No. 15 or No. 20 powder would be more suitable. Infusion of rhatany soon decomposes when kept, the rhatania-tannic acid being oxidised with formation of a copious deposit of rhatania-red. The same remark applies, in a less degree, to the tincture.

TINCTURA KRAMERIÆ—TINCTURE OF RHATANY.—*Take of rhatany root, in No.* 40 *powder*, 2½ *ounces; proof spirit*, 1 *pint.* Made by the same process as tincture of Aconite.

It would conduce to greater uniformity in the strength of galenical preparations if rhatany root was peeled when fresh, rejecting the inert meditullium, and sending only the dried bark into the market. With such a large root it makes a considerable difference in the astringency of the infusion or tincture if large roots are used at one time and smaller roots at another, owing to the varying proportion of inert woody matter.

Therapeutics.—Rhatany acts as a pure vegetable astringent. It is employed to check excessive mucous secretions, passive hæmorrhages, &c., and is useful in diarrhœa, dysentery, hæmaturia, passive hæmorrhage from the bowels, as a gargle in relaxed sore throat, internally, and as an injection in leucorrhœa, as an astringent application to the mucous membrane of the nose, eyes, gums, &c. Externally, it is applied to discharging ulcers, to arrest hæmorrhage from small vessels, &c.

Substitution or Adulteration.—*Savanilla Rhatany* bears a considerable resemblance to another variety called *Para Rhatany*, from being shipped from Pará in Brazil. It is also known as *Ceara Rhatany*, and is said to be obtained from *Krameria argentea*, Martius. It may be recognised by its brownish-grey colour, greater flexibility, and being in longer pieces than *Savanilla Rhatany*. It is much commoner in the British market than the latter, and being of good quality might advantageously have been made official. The roots of other species of *Krameria* are also occasionally met with in commerce.

Nat. Ord. **GUTTIFERÆ**—The Gamboge or Mangosteen Order. —Trees or shrubs, inhabiting tropical regions only, and more frequently in moist places. The plants yield a yellow gum resin, which is acrid and purgative. The fruits of many of them are edible, and the seeds of some are oily.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Garcinia Hanburii.	Gum-resin.	Cambodia and Cochin China.

Cambogia—Gamboge—Siam Gamboge.—A gum-resin[1] obtained from *Garcinia Hanburii*, Hook. fil. (*Garcinia Morella*, var. *pedicellata*, Hanbury).

[1] A gum-resin is a vegetable secretion consisting of a gum soluble in water and a resin soluble in spirit. A gum-resin forms an emulsion with water, and is thus distinguished from a resin such as resin of guaiacum, or an oleo-resin such as balsam of copaiba, which require the addition of gum before an emulsion can be formed. Some gum-resins, such as myrrh, also contain a volatile oil.

Characters and Tests.—In cylindrical solid or hollow rolls longitudinally striated on the surface,[1] and either distinct or more or less agglutinated or folded together into masses; breaking with a conchoidal fracture, the fractured surface being opaque, smooth, glistening and of a uniform reddish-yellow colour[2]; powder bright yellow; no odour; taste very acrid. When rubbed with water forming a yellow emulsion ; it is completely dissolved by the successive action of rectified spirit and water,[3] and an emulsion made with boiling water and cooled does not become green with the solution of iodine.[3]

Dose.—1 to 4 grains.

[1] The gum-resin occurs chiefly in numerous ducts situated in the middle layer of the bark, and is obtained by making a spiral incision into the bark round half the circumference of the stem. From this the gum-resin slowly exudes as a yellowish fluid, and collects in a joint of bamboo placed to receive it at the lower end of the incision. After hardening, the bamboo is removed, and the gamboge is obtained in the characteristic striated rods or cylinders which are imported by way of Singapore, Bankok, or Saigon. [2] Many inferior commercial samples are of a brownish hue, and present a rough, granular, bubbly surface when broken. [3] Sand, powdered *Garcinia* bark, and rice-flour sometimes occur as adulterations. The two former are detected by being insoluble in spirit and water, and the latter by the iodine test for starch, the blue iodide of starch and the gamboge yellow giving a green.

Active Principles.—Gamboge is a mixture of a *resin*, readily soluble in alcohol, with from 15 to 20 per cent. of a *gum*, resembling gum acacia, but differing from it in not being precipitated by neutral acetate of lead, nor by perchloride of iron. The resin possesses feeble acid properties, and is called *cambogic acid.* It is to it that gamboge owes its colour and medicinal activity.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Pilula Composita.	Gum-resin.	1 in 6.	5 to 10 grains.

PILULA CAMBOGIÆ COMPOSITA—COMPOUND PILL OF GAMBOGE.—*Take of gamboge, in powder, Barbadoes aloes, in powder, compound powder of cinnamon, of each,* 1 *ounce ; hard soap, in powder,* 2 *ounces; syrup, a sufficiency. Mix the powders together, add the syrup, and beat the whole into a uniform mass.*

Therapeutics.—Gamboge in medicinal doses is a drastic hydragogue cathartic, and in over-doses an irritant poison, causing vomiting, hypercatharsis, severe tormina, inflammation, ulceration and mortification of the intestines, and fatal exhaustion. Treatment of an over-dose, demulcent drinks and opiates. It is very rarely given alone, but either in combination with warm aromatic purgatives, as in the compound pill, or with calomel, cream of tartar, or jalap, in the treatment of dropsies, or as an adjunct to diuretic mixtures. Its use is contra-indicated in children, in debilitated persons, in pregnancy, and in all inflammatory and irritable states of the alimentary canal or adjoining viscera. It has been given also as a counter-irritant purgative in cerebral affections, and as an anthelmintic in tapeworm, but it is gradually falling out of use. It is not so hydrogogue as elaterium or jalap, while it is more disagreeable in its operation. A solution of the resin prepared by digesting gamboge, mixed with sand, in olive or almond oil, is used for colouring pomades.

Adulterations and Substitutions.—A variety of *Siam Gamboge*, possessing the same properties as *pipe* or *roll Gamboge*, is sometimes met with in large, irregular pieces, known as *lump* or *cake Gamboge*. *Ceylon Gamboge*, the produce of *Garcinia Morella*, Desr., occurs in tiers or irregular masses. *Indian Gamboge* is obtained in Southern India from *Garcinia pictoria*, Roxb. These both possess properties similar to the official *Gamboge*, but are of inferior quality, and more subject to adulteration.

Nat. Ord. **TERNSTRŒMIACEÆ or CAMELLIACEÆ**—The Tea or Camellia Order.—Most ornamental trees or shrubs. Chiefly natives of South America, but found also in the East Indies, China, and North America.

Official Plant.

Botanical Name.	Part Used.	Habitat.
CAMELLIA THEA.	Dried leaves.	India and China.

Camellia Thea—Thea Chinensis—The Tea Plant.—A native of Upper Assam ; cultivated in India, Ceylon, China, and Java.

THEÆ FOLIA.—The dried and prepared leaves of *Camellia Thea*, Link.

Characters.—The leaves are subjected to a rolling process which gives them a characteristic twisted appearance. There are two commercial varieties, known as Green Tea and Black Tea respectively. Green teas consist of the leaves quickly dried so as to preserve their colour and other natural properties. Black teas consist of the leaves dried after being allowed to lie in heaps till a kind of fermentation has taken place, which changes the original green colour to black, and otherwise alters their natural properties.

Active Principles.—The leaves contain from 0·6 to 1 per cent. of a *volatile oil*, to which their aroma is due, from 10 to 24 per cent. of an astringent body similar to *tannin*, and the Indian and Ceylon varieties from 3·22 to 4·66 per cent. of the alkaloid *theine* or *caffeine*, $C_8H_{10}N_4O_2,H_2O$. China and Java teas contain rather less alkaloid. Paul and Cownley found a minute proportion of a second alkaloid, probably the *theobromine* of Liebig and Zöller, but differing from both *theobromine* and *theine* by being readily soluble in ether. Kossel found probably the same alkaloid to which he gives the name *theophylline*, and the formula $C_7H_8N_4O_2$. He regards it as *dimethyl-xanthine.*

Official Preparations.

Name.	Part Used.	Dose.
Caffeina.	Dried leaves.	1 to 5 grains.
Caffeinæ Citras.	,,	2 to 10 grains.

CAFFEINA—CAFFEINE, THEINE, OR GUARANINE—$C_8H_{10}N_4O_2,H_2O$.—This alkaloid may be obtained from the leaves of common tea, and also from the dried seeds of *Coffea arabica*, Linn. (which see), by treating an aqueous infusion with subacetate of lead and ammonia, which precipitate astringent and colouring matters. Filter and remove traces of lead from the filtrate by a current of sulphuretted hydrogen; again filter and evaporate at a gentle heat. On cooling there is an abundant crystallisation of nearly pure caffeine, and an additional quantity may be obtained by concentrating the mother-liquor and leaving it to crystallise. The alkaloid can also be obtained by adding a strong solution of carbonate of potassium to the decolorised infusion evaporated to a small bulk. The alkaloid is precipitated, and may be crystallised from alcohol or by sublimation. See also GUARANA, KOLA-NUT, and PARAGUAY TEA. Commercially caffeine is mostly prepared in Germany from cheap or damaged teas. Recently, by special permission of the Revenue authorities, damaged tea has been used, duty free, in this country for the manufacture of the alkaloid.

Characters and Tests.—Colourless, silky, inodorous, acicular crystals. Soluble in 80 parts (100 Martindale) of water, the solution having a faintly bitter taste, and being neutral to litmus. More soluble in boiling water and in rectified spirit (1 in 25); very soluble in chloroform, and sparingly in ether. At 212° F. (100° C.) the crystals lose 8·49 per cent. of their weight, and at a higher temperature melt and volatilise without decomposition. Treated with a crystal of chlorate of potassium and a few drops of hydrochloric acid, and the mixture evaporated to dryness in a porcelain dish, a reddish residue results, which becomes purple when moistened with ammonia.[1] In an aqueous solution of the alkaloid tannic acid gives a white precipate, soluble in excess of the reagent.

[1] The chlorine liberated decomposes the caffeine with production of *amalic acid* or *tetramethyl-alloxantin*, $C_8(CH_3)_4N_4O_7,H_2O$. On addition of ammonia this forms *murexoïn* or *tetramethyl-murexide*, $C_8(CH_3)_4N_5O_6(NH_4)$, to which the purple colour is due.

CAFFEINÆ CITRAS—Citrate of Caffeine—$C_8H_{10}N_4O_2$, $H_3C_6H_5O_7$—A weak compound of caffeine and citric acid.—*Take of caffeine,* 1 *ounce; citric acid,* 1 *ounce; distilled water,* 2 *ounces. Dissolve the citric acid in the water, and stir the caffeine into the heated solution. Evaporate to dryness on a water-bath, constantly stirring towards the end of the operation. Reduce to fine powder.*

Characters and Tests.—A white inodorous powder with an acid and faintly bitter taste and an acid reaction on litmus.[1] It is soluble in a mixture of two parts of chloroform and one part of rectified spirit. With a little water it forms a clear syrupy solution, which on dilution yields a white precipitate of caffeine that redissolves when 10 parts of water have been added.[2] Heated in the air, the salt chars and burns leaving a mere trace of ash. From a boiling aqueous solution excess of lime gives a white precipitate. Tannic acid gives a white precipitate soluble in excess of the reagent. Treated as caffeine it yields the purple colour due to *murexoïn.*

[1] Caffeine possesses very feeble basic properties, and it is doubtful whether this is really a compound or merely a mixture of citric acid and caffeine. When treated with chloroform the caffeine dissolves out and leaves the citric acid. [2] Gerrard states that 30 parts of water are required before a clear solution is obtained. The pure alkaloid has occasionally been supplied as citrate.

The following non-official salts are also in use :—*Caffeinæ Ammonio-Citras—Dose,* 1 to 10 grains; *Caffeinæ Hydrobromas—Dose,* 2 to 5 grains; *Caffeinæ Sodio-Salicylas—Dose,* 1 to 4 grains hypodermically, soluble 1 in 2 of water; *Caffeinæ Sulphas—Dose,* $\frac{1}{2}$ to 5 grains, soluble 1 in 40 of water; *Caffeinæ Valerianas—Dose,* $\frac{1}{2}$ to 3 grains. Caffeine is readily soluble in aqueous solutions containing chemically equivalent quantities of benzoate, cinnamate, and salicylate of ammonium or sodium. Caffeine, 20 grains, sodium salicylate, $17\frac{1}{2}$ grains, and water 1 fluid drachm, make a suitable hypodermic solution.

Therapeutics.—It is probable that the exhilarating effects of tea are due in some measure to the astringent principle, the exact nature of which is not yet fully known, and also to the volatile oil. The commercial value of tea appears to depend more on these than on the percentage of alkaloid, which is present in quite as large quantity in many of the cheaper teas as in the more expensive. Tea is used as a cerebral stimulant to relieve drowsiness and headache. When taken too freely it produces sleeplessness, giddiness, restlessness, trembling of the hands and indigestion. *Caffeine* stimulates the heart and raises arterial tension. It is used in headache, especially migraine. As a diuretic it is specially useful in cardiac dropsy, but may be given also in cases of hepatic dropsy. It acts even when the kidneys are diseased, and may be usefully employed in very advanced cardiac cases. It is best given alternately with digitalis or along with it. The hypodermic solution is recommended for alcholic and morphine intoxication. In excessive doses it causes rise of temperature, convulsions, and paralysis. Locally applied it dilates the pupil of the eye.

Adulterations.—Green tea is frequently artificially "faced" with prussian blue, gypsum, and turmeric. Both black and green teas sometimes contain the leaves of other plants such as willow, sloe, elm, &c. Such adulterations are easily detected.

Nat. Ord. **MALVACEÆ**—The Mallow Order.—Herbs, shrubs, or trees inhabiting tropical and the warmer parts of temperate regions. The plants are generally mucilaginous and demulcent, and are not deleterious.

Official Plant.

Botanical Name.	Parts Used.	Habitat.
Gossypium barbadense.	Hairs of Seed.	West Indies.

Gossypium Barbadense.—Cotton—Sea Island Cotton.

Gossypium—Cotton-Wool.—The hairs of the seed of *Gossypium barbadense*, Linn., and of other species of *Gossypium*, from which fatty matter and all foreign impurities have been removed.

Characters and Tests.—In white soft filaments, each consisting of an elongated tubular cell, and when examined under the microscope appearing as a flattened and twisted band, with slightly thickened rounded edges; inodorous and tasteless. It should readily be wetted by water, to which it should not communicate either an alkaline or acid reaction. On ignition in air it burns, leaving less than 1 per cent. of ash.[1]

What is commercially known as absorbent cotton is now alone official. Ordinary cotton contains from 9 to 10 per cent. of fixed oil, which prevents its being readily wetted with water. This is removed by treatment with alkalies, and the absence of any reaction shows that the wool has been thoroughly washed after treatment.

Official Preparation for which Cotton Wool is used.—Pyroxylin.

Pyroxylin—Gun-Cotton—Dinitro-cellulose.

PREPARATION.—*Take of cotton,* 1 *ounce; sulphuric acid, nitric acid, of each,* 5 *fluid ounces. Mix the acids in a porcelain mortar, immerse the cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the acids. Transfer the cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washings cease to give a precipitate with chloride of barium. Drain the product on filtering paper, and dry in a water-bath.*

Test.—Readily soluble in a mixture of ether and rectified spirit[2]; leaves no residue when exploded by heat.

[1] Cotton-wool consists of almost pure *cellulose,* $C_6H_{10}O_5$. By the official process 2 molecules of peroxide of nitrogen (NO_2) are substituted for 2 atoms of hydrogen, producing *dinitro-cellulose,* $C_6H_8(NO_2)_2O_5$., or *pyroxylin.* [2] *Mononitro-cellulose,* $C_6H_9(NO_2)O_5$., and *trinitro-cellulose,* $C_6H_7(NO_2)_3O_5$., are insoluble in a mixture of ether and rectified spirit, and would thus be detected if present in the pyroxylin. *Trinitro-cellulose* alone is sufficiently explosive for use in place of gunpowder.

COLLODIUM—COLLODION.—*Take of pyroxylin,* 1 *ounce; ether,* 36 *fluid ounces; rectified spirit,* 12 *fluid ounces. Mix the ether and the spirit, and add the pyroxylin. Set aside for a few days, and should there be any sediment, decant the clear solution. Keep it in a well-corked bottle.*

Characters.—A colourless highly inflammable liquid, with ethereal odour, which dries rapidly upon exposure to the air, and leaves a thin transparent film, insoluble in water or rectified spirit.

COLLODIUM FLEXILE — FLEXIBLE COLLODION.— *Take of* *collodion*, 12 *fluid ounces; Canada balsam*, ½ *ounce; castor-oil*, ¼ *ounce. Mix, and keep in a well-corked bottle.*

COLLODIUM VESICANS.—BLISTERING COLLODION—*Take of blistering liquid*, 20 *fluid ounces; pyroxylin*, 1 *ounce.*[1] *Add the pyroxylin to the liquid in a stoppered bottle, and shake them together until the former is dissolved.*

[1] It has been alleged that the proportion of pyroxylin in the above is too high, and a smaller proportion would be an improvement. There have been several instances of the preparation gelatinising, and this seems to be due to the pyroxylin used in these cases not being strictly B.P.

OLEUM GOSSYPII SEMINUM — COTTON-SEED OIL—(*not official*).—Cotton seeds yield, by expression, about 25 per cent. of a bland fixed oil which has been recommended as a substitute for almond and olive-oil in pharmacy. It is used for salads and in soap manufacture, and also for burning, and as a lubricant for machinery. Olive-oil is frequently adulterated with it.

Therapeutics.—Cotton-wool is used as a local application to exclude external irritation and protect the part from cold in cases of burns and erysipelas. It is also employed to surround gouty or rheumatic joints. A pledget of cotton wool in the ear tends to prevent sore throat. It is used as a dressing to wounds, from which it excludes the germs which might cause pyæmia, erysipelas, &c. For this and other purposes it may be impregnated with various antiseptics and deodorising substances, such as carbolic acid, corrosive sublimate, benzoic acid, iodine, iodoform, picric acid, and salicylic acid. Collodion acts as a protective when applied to the skin, and also through its contraction exerts a gentle pressure on the part, and is hence applied to cut surfaces, chapped nipples, and to check hæmorrhage from leech-bites. Flexible collodion does not crack, and is therefore more useful as a protective, but it does not exert so much pressure as the ordinary collodion. Collodion has been used as a convenient vehicle for the local application of various remedies. Salicylic acid, 60 grains, and extract of Indian Hemp, 8 grains, dissolved in 1 ounce of flexible collodion, has been extensively used as a rapid and painless solvent for corns and warts. Blistering collodion when painted on the skin is a rapid and powerful vesicant. It is said to act more rapidly if covered immediately with oiled silk. Cotton-root bark has been highly commended as an emmenagogue and parturient. A tincture, bark 1, proof spirit 4, is employed in doses of 1 drachm 3 times a day.

Althæa officinalis—Common Marsh-Mallow—(*not official*).

Botany.—Stem, annual, erect, round, smooth, simple, branched towards the top, 2 or 3 feet high. *Leaves*, alternate, ovate, pubescent on both sides, feel smooth and velvety. *Inflorescence*, dense axillary pomicles, *flowers* pale rose-coloured. *Flowering time*, July to September. *Habitat*, indigenous marshy places near the sea. *Althæa radix*, the root deprived of its brown corky layer and small rootlets, and dried, is the part used. It is employed medicinally as a demulcent or emollient in the form of decoction or syrup. The root contains *mucilage*, *sugar*, *starch*, and a neutral crystalline nitrogenous substance termed *asparagin*. Its virtues are due to the *mucilage*. A favourite preparation in France is the confection known as *pâte de guimauve*.

Malva Sylvestris—Common Mallow—(*not official*).

Botany.—Stem, erect, branched, 2 to 4 feet high. *Leaves*, on long petioles, with 5 to 7 deep crenate lobes. *Inflorescence*, axillary, *flowers* numerous, purplish-red. *Flowering time*, June to September. *Habitat*, indigenous, hedges and roadsides. The entire plant is used. Its properties are due to a tasteless *mucilage* which it contains in large quantity. It may be used either internally as a demulcent infusion or decoction, or externally as an emollient poultice or fomentation.

Nat. Ord. **STERCULIACEÆ**—The Silk Cotton or Chocolate Order.—The plants of this order are chiefly tropical. In their properties they resemble the Malvaceæ; being generally mucilaginous, demulcent, and emollient. Some plants are reputed to be diuretic, emetic, or purgative.

Official Plant.

Botanical Name.	Part Used.	Habitat.
THEOBROMA CACAO.	Concrete Oil.	South America.

Theobroma Cacao—Cocoa or Chocolate Tree.

OLEUM THEOBROMATIS — OIL OF THEOBROMA — CACAO BUTTER.—A concrete oil obtained by expression and heat from the ground seeds of *Theobroma Cacao*, Linn.

Characters.—Of the consistency of tallow; colour yellowish; odour resembling that of chocolate; taste bland and agreeable; fracture clean, presenting no appearance of foreign matter. Does not become rancid from exposure to the air. It usually melts at temperatures between 86° and 95° F. (30° and 35° C).

The cocoa or chocolate tree is extensively cultivated in the tropical regions of the New and Old Worlds, especially in the West Indian Islands. The seeds are the part employed. They contain from 45 to 50 per cent. of the concrete fixed oil known as *Cacao Butter*, which is partially removed by heat and expression in the manufacture of cocoa. It is from this source that the commercial supplies are derived. *Cacao Butter* usually occurs in flattened cakes or oblong tablets, averaging half a pound in weight. It softens, without quite fusing, at the temperature of the body, and has no irritating properties. These qualities and its non-liability to become rancid render it specially suitable as a basis for suppositories and pessaries. When large quantities of soft extracts or fluids are ordered in such forms, a little yellow wax should be added, otherwise the mass will be too soft. Its chief constituents are *stearin* and *palmitin*, with a little *olein*. The seeds owe their mildly stimulating properties to an alkaloid, *theobromine*, $C_7H_8N_4O_2$, which is chemically related to *caffeine;* the latter being *methyl-theobromine.* Both alkaloids are derivatives of *xanthine*, an alkaloid derived from *guanine*, $C_5H_5N_5O$, an alkaloid found in guano. *Theobromine* is regarded as *dimethyl-xanthine* and *caffeine* as *trimethyl-xanthine.* The seeds contain from 1·2 to 1·5 per cent. of *theobromine.*

Therapeutics.—Cacao Butter is used in the preparation of suppositories, pessaries, ointments, soaps, &c., and also as an application to chapped lips and hands. It has been recommended internally as a substitute for cod-liver oil in cases in which the objections to the latter are insuperable. It is also used to coat pills. Both cocoa and chocolate are extensively used for the preparation of an agreeable and nutritious beverage, which is less stimulating than tea or coffee, but apt to disagree with many persons on account of its fatty nature.

Adulterations.—Cacao Butter is said to be frequently adulterated with animal fat. This may be detected by dissolving the suspected sample in two parts of ether, if it becomes turbid after standing, or forms on spontaneous evaporation little crystals or grains, not soluble in two parts of ether at common temperature, it is impure, and should be rejected. The specific gravity should be very near ·961.

Sterculia Acuminata—Kola-nut Tree of Western Africa—Guru-nut Tree of the Soudan—(*not official*).—The seeds are used in various parts of Africa as food and medicine, and have been recently imported into this country in considerable quantities. The *Kola-nut* is roundish, compressed, resembling the European chestnut, and of a bitter taste. They contain from 2·13 to 2·35 per cent. of *caffeine*, to which they owe their properties. *Kola-paste* has been recommended as a substitute for chocolate. It acts as a tonic and astringent, and has been employed with success in the diarrhœa of hot climates. Its use is likewise indicated in cardiac affections and cachexia. It is used by the native Africans to cure drunkenness.

Adulterations.—Seeds of the following plants are sometimes either accidentally or intentionally mixed with the *Kola-nuts* of commerce; *Heritiera littoralis*, a plant belonging to the natural order *Sterculiaceæ*, distinguished by starch-grains only half the size of those in true *Kola*, and by having cotyledons of unequal size, one only half the size of the other, and giving the seed an orbicular flattened appearance; *Garcinia Kola* and *Pentadesma butyracea*, both belonging to the natural order *Guttiferæ*. The former contains two resins to which its bitterness is due; the latter is distinguished by the fatty matter it contains, and of which it yields 32·5 per cent. None of these seeds contain any trace of *caffeine*.

Nat. Ord. **DIPTERACEÆ**—The Sumatra Camphor Order—(*not official*).—Large trees with an oleo-resinous juice. Natives of the tropical East Indies.

Diptero-carpus lævis or **turbinatus**.—Yields Wood Oil or Gurjun Balsam. *See* Copaiba.

Dryobalanops aromatica or **Camphora**.—Yields Borneo Camphor. *See* Camphor.

Nat. Ord.—**LINACEÆ**—The Flax Order.—Herbs, or rarely shrubs, inhabiting the south of Europe and the north of Africa chiefly. The plants are remarkable for the mucilage and oil of their seeds, and also for the tenacity of their liber-fibres. They are generally emollient and demulcent, but some are bitter, purgative, or diuretic. The genus *Erythroxylon* is now included in this order.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
LINUM USITATISSIMUM.	Ripe seeds.	Britain.
ERYTHROXYLON COCA.	Dried leaves.	Peru.

Linum usitatissimum.—Flax—Cultivated Flax.

LINI SEMINA—LINSEED.—The dried ripe seeds of *Linum usitatissimum*, Linn.

Characters and Tests.—Small, varying in length from about $\frac{1}{16}$ to $\frac{1}{4}$ of an inch, more or less flattened, ovoid, somewhat obliquely pointed; brown, smooth, and shining on their outer surface, internally yellowish-white. Odourless, but with a mucilaginous oily taste. A decoction of linseed, when cold, is not made blue by solution of iodine.[1]

[1] Unripe seeds contain starch, and would give a blue colour, as would also any cereal grain if present.

Active Principles.—The seeds contain about 33 per cent. of *fixed oil*, and yield on pressure from 20 to 30 per cent., according to the quality of the seeds. The commercial oil is of a dark yellow colour, and has a sharp repulsive taste and odour. On exposure to air, especially after being boiled with oxide of lead, it increases in weight by oxidation, and soon dries up to a transparent varnish, and hence it is called a *drying oil.* It consists mainly of *linolein*, a compound of *glyceryl* and a peculiar acid, *linoleic acid*, $C_{16}H_{26}O_2$. The seeds also contain about 15 per cent. of a viscid *mucilage*, which is extracted by water and is said to have the formula $C_{12}H_{20}O_{10}$. It is found only in the testa of the seeds.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Farina.	Ripe seeds.	...	...
Infusum.	"	15 grs. to ℥ i.	Ad libitum.
Oleum.	"	...	...

LINI FARINA—Linseed-Meal.—Linseed reduced to powder.[1]

[1] The powdered cake of linseed from which the oil has been pressed was official in the 1867 Pharmacopœia, but its place has now been taken by the powdered or crushed seeds containing the oil. For medicinal purposes the latter is much superior, as the former, when applied as a poultice, had the disadvantage of caking. Owing to rupture of the cells and exposure of the oil to the air, it soon gets oxidised, and becomes rancid and irritating. For this reason the U.S.P. orders it to be recently prepared. It should be free from unpleasant or rancid odour, and when extracted with bisulphide of carbon should yield not less than 25 per cent. of fixed oil. It enters into the composition of all the official *cataplasmata* except *Cataplasma Fermenti.*

INFUSUM LINI—Infusion of Linseed.—*Take of linseed*, 150 *grains; dried liquorice root, in No. 20 powder, 50 grains; boiling distilled water, 10 fluid ounces. Infuse in a covered vessel for two hours and strain.*[1]

[1] This preparation contains only the *mucilage* of the linseed.

OLEUM LINI—LINSEED OIL.—The oil expressed in Britain without heat from linseed.

Characters.—Viscid, yellow, with a faint odour, and bland oleaginous taste. It gradually thickens by exposure to air.[1]

[1] These characters apply to an oil prepared for medicinal purposes. By cold expression the seeds yield less than 20 per cent. of oil having a specific gravity of 0·932, and congealing at 4° F. On the large scale the crushed seeds are subjected to heat during expression, and generally the seeds are roasted before being pressed to destroy the gummy matter in their coating. The oil is thus obtained more free from mucilage, and in larger proportion, but more highly coloured and acrid, than when obtained by cold expression.

Therapeutics.—Linseed acts as a demulcent and emollient. *Linseed tea*, made, like the official infusion, with the seeds, sweetened with honey, sugar candy, or liquorice juice, and flavoured with lemon, is an agreeably pectoral drink, and when largely taken acts somewhat as a soothing diuretic. The oil acts as an emollient, and with *Liquor Calcis* forms the celebrated *Carron-Oil*, used as an application to burns. The oil acts also as a laxative, but is rarely used as such otherwise than as an enema. The poultice made with the meal is an excellent emollient application, useful in a variety of cases; the meal should be fresh, otherwise, especially if it contain rancid oil, it may irritate the skin and cause a disagreeable pustular eruption. The demulcent effects of linseed are valuable in bronchial affections, diarrhœa, dysentery, inflammation of the abdominal viscera, inflammatory affections of the genito-urinary passages. Lint, which is so largely employed as an absorbent dressing for wounds, &c., consists of the *liber-fibres* of the flax plant.

Adulterations.—Linseed frequently contains considerable quantities of the seeds of various weeds and cereal grains, which are either due to careless harvesting or to intentional admixture. In 1864 the *Linseed Association of London* was formed to check this abuse, and they decided to refuse all samples containing more than 4 per cent. of foreign seeeds. The most objectionable of these adulterants are the seeds of various species of *brassica*. These contain a fixed non-drying oil, which contaminates the linseed oil and unfits it for use in the arts. The meal, made from such contaminated linseed, also yields a pungent, irritating, volatile oil when mixed with water. Foreign seeds can be readily detected in the whole linseed from their appearance. In the meal seeds containing starch are detected by the iodine test, and cruciferous seeds by the pungent odour developed on moistening the meal with water. Linseed oil is sometimes adulterated with resin oil, paraffin oil, cod and other fish oils, cotton-seed and niger-seeds oils. The best oil is that which dries most rapidly and perfectly on exposure to the air.

Erythroxylon Coca—Coca or Cuca Plant.

COCA—CUCA.—The dried leaves of *Erythroxylon Coca*, Lamarack.

Characters.—Shortly stalked, oval or lanceolate, of varying thickness, one or two inches or more in length, entire, usually blunt and emarginate, quite smooth; midrib prominent, with numerous faint, freely anastomosing lateral veins, and on each side of the midrib a curved line extends from base to apex [1]; green above, somewhat paler beneath. In commercial specimens the leaves are more or less broken, and frequently yellowish-green,[2] yellowish-brown, or brown,[3] and in rare cases the curved lines are indistinguishable. Odour faintly tea-like, especially when bruised; taste somewhat bitter and aromatic.

[1] This very characteristic feature is caused by the way in which the leaf has been folded in the leaf-bud. [2] The greenish coloured leaves are the best. [3] Brown leaves should be rejected as inferior; they contain no *cocaine*. Two varieties of the leaves have been recognised in commerce. The one, known as Truxillo Coca, consists of light-green, thin, small, very much broken leaves, with a few stems, twigs, and seed capsules. The other, known as Huanuco Coca, consists of larger, thicker, less broken leaves, of a darker green or brownish-green colour, and free of stems or twigs.

Dose.—$\frac{1}{2}$ to 1 dram.

Active Principles.—The most important constituent of Coca leaves is the alkaloid *cocaine*, $C_{17}H_{21}NO_4$, of which good leaves yield from 0·5 to 0·8 per cent. *Cocaine* is very unstable, and, when heated with water, speedily decomposes as follows:—

$$\underset{\text{Cocaine.}}{C_{17}H_{21}NO_4} + H_2O = \underset{\text{Benzoyl-ecgonine.}}{C_{16}H_{19}NO_4} + \underset{\text{Methyl alcohol.}}{CH_3HO.}$$

If heated with dilute acids or alkalies more complete decomposition is induced as follows:—

$$\underset{\text{Cocaine.}}{C_{17}H_{21}NO_4} + 2H_2O = \underset{\text{Ecgonine}}{C_9H_{15}NO_3} + \underset{\text{Benzoic acid.}}{HC_7H_5O_2} + \underset{\text{Methyl alcohol.}}{CH_3HO.}$$

Cocaine is therefore *methyl-benzoyl-ecgonine.* The leaves also yield a considerable quantity of an amorphous alkaloidal mixture which consists mainly of another alkaloid *cocamine*, or *isatropylcocaine*, $C_{19}H_{23}NO_4$. When heated in a sealed tube with hydrochloric acid *cocamine* decomposes as follows:—

$$\underset{\text{Cocamine.}}{C_{19}H_{23}NO_4} + 2H_2O = \underset{\text{Ecgonine.}}{C_9H_{15}NO_3} + \underset{\text{Isatropic acid.}}{HC_9H_7O_2} + \underset{\text{Methyl alcohol.}}{CH_3HO}.$$

Cocamine is therefore *methyl-isatropyl-ecgonine.* *Cinnamylcocaine* has also been found in some samples of leaves. The alkaloids *benzoyl-ecgonine* and *ecgonine* probably do not exist ready formed in the leaves, though the former may be present in leaves which have been badly dried or heated. A volatile liquid alkaloid, *hygrine*, has been obtained by distilling amorphous coca alkaloids in a current of steam. It occurs as a dark brown oily liquid of high boiling-point, peculiar smell, and burning taste. *Ecgonine*, $C_9H_{15}NO_3$, is the basis of all the coca alkaloids except perhaps *hygrine.* Einhorn has shown that it is very closely allied chemically to *tropine*, the alkaloid produced by decomposition of *atropine* or *hyosyamine.* He has succeeded in converting *ecgonine anhydride* into *tropine anhydride*, and only a few links in the chain are wanted to complete the synthetical production of both *cocaine* and *atropine.* The leaves also contain *coca-tannin*, which is said to resemble closely *caffeo-tannin.*

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum Liquidum.	Dried leaves.	1 in 1	$\frac{1}{2}$ to 2 drachms.
Cocainæ Hydrochloras.	" "	...	$\frac{1}{5}$ to 1 grain.
Lamellæ Cocainæ.	Cocaine hydrochlorate.	$\frac{1}{200}$ grain in each.	

EXTRACTUM COCÆ LIQUIDUM.—LIQUID EXTRACT OF COCA.—*Take of coca leaves, in No.* 40 *powder*, 20 *ounces; proof spirit, a sufficiency. Mix the leaves with* 2 *pints of the spirit in a closed vessel for* 48 *hours; then transfer to a percolator, and continue the percolation with more of the spirit until the leaves are exhausted. Reserve the first* 15 *fluid ounces of the percolate, and evaporate the remainder by a water-bath to the consistence of a soft extract. Dissolve this in the reserved portion, and make up the volume to* 20 *fluid ounces by the addition of more spirit.*

This is a general process for the preparation of fluid extracts, or as they are sometimes called "valoids" from the fact that 1 fluid ounce represents 1 ounce of the drug. The first 15 ounces, which are reserved, contain the greater proportion of the active constituents of the drug as well as the volatile aromatic principles. By this means destruction of active principles and loss of aroma by the heating necessary for evaporation are avoided. There is, however, considerable loss of alcohol, and to obviate this objection, and do away with all evaporation, Dr Squibb has devised a modification of the above process which he calls "Repercolation." By this process the drug is divided into separate portions, and the same menstruum is passed through each in succession. The result is that the same menstruum, acting repeatedly on unexhausted portions of the substance, becomes concentrated to the greatest possible extent. The value of this improvement is now generally recognised, and, in various forms, is extensively employed by practical pharmacists. It has been found, in practice, that the very fine disintegration ordered in the Pharmacopœia is not required. Percolation should proceed only at such a speed as the menstruum can be passed through the tissues of the drug, and exhaustion is quite easily secured with a much less degree of comminution than that prescribed.

COCAINÆ HYDROCHLORAS—HYDROCHLORATE OF COCAINE—($C_{17}H_{21}N_4$,HCl).—*It may be obtained by agitating with ether an aqueous solution of an acidulated alcoholic extract, made alkaline with carbonate of sodium; separating and evaporating the ethereal liquid, purifying the product by repeating the treatment with acidulated water, carbonate of sodium, and ether; decolorising; neutralising with hydrochloric acid, and recrystallising.*[1]

[1] The above is a general process for separation of alkaloids, founded on the principle that free alkaloids are soluble, but salts of alkaloids insoluble in ether. Tartaric acid may be the acid employed, so that the aqueous solution contains the alkaloid in the form of tartrate. On adding the carbonate of sodium (bicarbonate is better) to this the alkaloid is set free and dissolves in the ether, in which most of the plant constituents are insoluble. Oils, fats, and resins are, however, dissolved out by the ether. These may be got rid of by shaking up the ethereal solution with an aqueous solution of tartaric acid. The acid combines with the alkaloid to form tartrate, which is insoluble in the ether, and passes into the aqueous liquid, which can then be separated from the ether in which the fats, oils, and resins remain dissolved. By again adding bicarbonate of sodium to the aqueous solution the alkaloid is set free, and can be separated

in a purer state by again agitating the aqueous solution with ether, which is separated, and on evaporation leaves the alkaloid. The Pharmacopœia suggests further decolorisation of the alkaloid by treatment with animal charcoal, but this should be unnecessary. Dr Squibb employs a modification of the foregoing process, in which the leaves are exhausted by repercolation with water to which 5 per cent. of sulphuric acid has been added. This yields a very concentrated fluid extract containing sulphate of *cocaine*. The extract is made alkaline by adding carbonate of sodium, and agitated with kerosene oil (or petroleum spirit). The kerosene oil dissolves out the *cocaine* almost free from colouring matter or other substances. The alkaloid is washed out of the kerosene oil by agitation with more acidulated water, and again separated by addition of carbonate of sodium and ether, which dissolves out the *cocaine* practically colourless. From the ether the alkaloid is separated as hydrochlorate by agitating the ethereal liquid with separate portions of dilute hydrochloric acid. The first portions contain any remaining colouring matter, and are reserved to be worked up in a subsequent operation. The colourless fractions are evaporated in very shallow pans at a very low temperature with constant stirring. The product is a granular coarse powder of broken crystals, made uniform by passing through a No. 40 sieve. From this cocaine-hydrochlorate may be obtained in crystals by recrystallising from alcohol. The alkaloid is also prepared by macerating the leaves with solution of sodium carbonate, drying the mixture, and exhausting with petroleum spirit. The product contains *cocaine* tolerably free from colouring matter. It is shaken up with very dilute hydrochloric acid, thus forming hydrochlorate, which is insoluble in petroleum spirit, and passes into the aqueous layer which is separated. To the aqueous solution carbonate of sodium is added, thus setting free the alkaloid which is shaken out with ether. On evaporating the ethereal solution crystals of *cocaine* in a nearly pure state are obtained. *Cocaine* is also manufactured by decomposing the amorphous coca bases, and separating the *ecgonine* thus obtained. From this the *cocaine* is prepared synthetically. It is now largely manufactured in a crude state in South America, and purified and converted into hydrochlorate after arrival in Europe.

Characters and Tests.—In almost colourless acicular crystals or crystalline powder, readily soluble in water (2 in 1), alcohol (1 in $2\frac{1}{2}$), and ether.[1] Its solution in water has a bitter taste ; gives a yellow precipitate with chloride of gold, and a white precipitate with carbonate of ammonium, soluble in excess of the reagent. Its solution produces on the tongue a tingling sensation followed by numbness.[2] The aqueous solution dilates the pupil of the eye. It dissolves without colour in cold concentrated acids, but chars with hot sulphuric acid. The solution yields little or no cloudiness with chloride of barium,[3] or oxalate of ammonium.[4] Ignited in the air it burns without residue.

[1] This is incorrect. The alkaloid *cocaine* is freely soluble in ether, but the hydrochlorate is almost insoluble. It is soluble 1 in $2\frac{1}{2}$ of glycerine. [2] This sensation is so marked that it can be produced by placing on the tongue and holding against the roof of the mouth for one minute a small square of filtering-paper containing $\frac{1}{4000}$ of a grain of the salt. It serves as a rough test of the purity of a sample, and is known as the physiological test. [3] Indicating absence of sulphuric acid. It might have been noted that it gives the chloride reaction with nitrate of silver. [4] Indicating absence of lime.

A solution of 1 grain in 1 drachm of distilled water, to which 2 drops solution of potassium permanganate have been added, should retain the red colour for some time. The official salt is anhydrous, but it may also be obtained with 1, 2, 3, or 4 molecules of water of crystallisation. The pure anhydrous salt should dissolve in the proportion of 0·4 gram in not much less than 9 c.c. of pure chloroform of sp. gr. not below 1·47. The hydrated salt is much more soluble, as is also a sample containing adherent moisture or decomposition products (Squibb).

LAMELLÆ COCAINÆ—Discs of Cocaine.—*Disc of gelatine, with some glycerine, each weighing about $\frac{1}{50}$ of a grain, and containing $\frac{1}{200}$ grain of hydrochlorate of cocaine.*

This is one of a new class of preparations known as Lamels. They are prepared by adding a solution of the alkaloid to a hot solution of gelatine in proper proportion. The solution is poured on a slightly greased glass or porcelain plate, cooled and dried, and then cut into discs with a punch, so that each disc contains $\frac{1}{200}$ of a grain of the salt. A little glycerine is added to prevent them becoming too hard and dry.

EXTRACTUM COCÆ—Extract of Coca—(*not official*).—A green alcoholic extract prepared from dried leaves.

Dose.—2 to 10 grains.

VINUM COCÆ—Wine of Coca—(*not official*).—1 part of leaves or fluid extract in 30 parts of sherry, port, or red wine. The American Formulary gives 30 grains to each fluid ounce.

Dose.—$\frac{1}{2}$ to 2 ounces.

COCAINA — COCAINE —($C_{17}H_{21}NO_4$) — (*not official*).—The alkaloid occurs in well-formed, colourless, monoclinic prisms, melting at 98° C. Solubility in water 1 in 1300, rectified spirit 1 in 20, freely in chloroform; ether, benzol, and amylic alcohol 1 in 3, petroleum spirit 1 in 25, oleic acid 1 in 4, vaseline and fixed oils 1 in 10, insoluble in glycerine.

Dose.—$\frac{1}{16}$ to 1 grain.

The following non-official salts of *Cocaine* are also used in medicine :—

COCAINÆ CITRAS—CITRATE OF COCAINE.—Occurs in small, white, deliquescent crystals. *Dose.*—$\frac{1}{20}$ to 1 grain. COCAINÆ HYDROBROMAS—HYDROBROMATE OF COCAINE —($C_{17}H_{21}NO_4$,HBr).—A stable salt in small, white, hard, acicular crystals. *Dose.*—$\frac{1}{20}$ to 1 grain. COCAINÆ SACCHARIS —SACCHARITE OF COCAINE.—A compound of *cocaine* and *saccharin* in the form of a white, deliquescent, amorphous salt, very soluble in water. *Dose.*—$\frac{1}{5}$ to 1 grain. COCAINÆ SALICYLAS (?)— SALICYLATE OF COCAINE.—A salt is met with under this name in minute, snow-white, deliquescent crystals, but it is probably not salicyclate of *cocaine* as the alkaloid is chemically altered when acted upon by either benzoic or salicylic acid. The salt frequently has a distinct odour of oil of wintergreen (methyl salicylate), due, doubtless, to the chemical change referred to. *Dose.*—$\frac{1}{5}$ to 1 grain.

Therapeutics.—Coca leaves have been used from time immemorial as a nerve stimulant by the natives of Bolivia and Peru. Their general effects are well summarised by Von Bibra in the words— "It satisfies the hungry, lends new strength to the weary and fatigued, and makes the unhappy forget his griefs." These effects are confirmed by all who have made observations. Coca is taken by the Indians in repeated small doses, and it is in this way that the greatest benefit is obtained. Large doses produce toxic symptoms, such as loss of co-ordination, paresis, incoherence of ideas, &c. In this respect it resembles opium, alcohol, and caffeine. The moderate use of coca is beneficial to the Indian, and excessive indulgence is very rare. The stimulating effects are more dwelt upon by writers than the narcotic action. They speak of the feeling of buoyancy and lightness, the increased power of work and prolonged sleeplessness. But, especially when small doses are taken, the first effect is sedative. There is a slight dulling of the central nervous system, inducing a gentle dreaminess and abstraction from the outer world. This initial narcosis is followed by a much longer period of nervous and muscular stimulation. The coca chewer thus obtains the pleasurable effects of both *morphine* and *caffeine*. The soothing effects of the former are experienced without any of the after depression and mental confusion following the use of opium; these being averted by the subsequent stimulating effect which is even more marked than that induced by *caffeine*. Large doses of coca, however, cause headache and mental unfitness next day. Excessive indulgence completely breaks down the nervous system, and, while moderate use stimulates peristalsis, excessive and prolonged use induces obstinate constipation, a result attributed to neuro-muscular paralysis of the bowel. The evidence is very conflicting as to whether coca owes its hunger allaying and sustaining powers to any effect in diminishing metabolism. It has been suggested that it acts on muscle in such a way as to modify its chemical activity, so as to enable an equal or greater amount of work to be done with a lesser consumption of carbohydrates. It would thus act, not only as a nerve stimulant, but also as an economiser of the bodily expenditure. The Indians while chewing it, mixed with the ashes of the opium plant, or lime, pass whole days in travelling or working without food. From 2 to 8 or 12 drachms are used daily. Coca has been praised as a nervine and muscular tonic. It has been used in asthma, bronchitis, obstinate cough, phthsis, general debility, indigestion, gastralgia, gastrodynia, nausea, vomiting of pregnancy, and as a cure for morphine and alcohol craving. It is said sometimes to produce "Coca Craving." Its stimulating effect on the cerebrum has led to its extensive use in melancholia, neurasthenia, and hysteria, but the results obtained have not been satisfactory. It is useful in cases marked by inordinate hunger or thirst. Coca pastils are useful for loss of voice, due to weakness or relaxation of the vocal chords. They are also recommended for hay-fever, spasmodic asthma, and post-nasal catarrh. Wine of coca stimulates digestion, and is useful in checking vomiting due to irritable stomach. The alkaloid *cocaine* has come into extensive use as a local anæsthetic. This property was observed by the discoverer of the alkaloid—Niemann—in 1860, but its practical importance was not realised until 1884, when Koller of Vienna was led to test the local anæsthetic action of the hydrochlorate which had been painted on the pharynx to render it less susceptible during laryngoscopic examination. The alkaloid or its salts when applied to any mucous membrane or exposed surface produces a peculiar pallor, followed by complete loss of sensitiveness. One great advantage of this local insensibility is the fact that it is limited to the tissues to which the *cocaine* has been applied. But when subcutaneously injected it also acts as a general analgesic, and its injection at any point eases the pain in neuralgia, showing that its effects must be central as well as local. When applied to a very sensitive membrane, such as the conjunctiva, a burning sensation is at first produced, but this is rapidly followed by a condition in which the part may be cut or burnt without the patient being conscious of it. *Cocaine* destroys not only tactile sensibility, but also removes the power of taste and smell. On account of its power of producing local anæsthesia, it has been very extensively employed in ophthalmic surgery, in dentistry, in obstetrics, and various diseases of the genito-urinary organs. In surgical operations about the eye, nose, and mouth, unless the cutting is to be deep or extensive, a simple application of a 4 per cent. solution once or twice by a camel's hair brush is sufficient. When deeper or more extensive operations are required, the surface application must be supplemented by hypodermic injections. No operation should be commenced until at least 10 minutes after the first application. Its action commences in 3 minutes, increases from 10 to 20 minutes, and disappears within half an hour. No injurious effects, either local or constitutional, seem to follow its use. Aqueous solutions of *cocaine* are prone to the development of fungoid growths. The occurrence of sudden fainting and alarming symptoms of collapse, in a few cases when *cocaine* has been applied superficially or hypodermically, have been attributed to the presence or products of these growths. Various antiseptics have been added to the solutions as preventives of fungoid growth. Chloroform answers best except for eye drops. But Martindale has found that only some samples of the salt are prone to develop fungi ; and by a careful selection and sterilisation of the solution in distilled water by boiling, and subsequent exclusion of dust—such additions are found to be unnecessary. Injected locally, *cocaine* has been found more useful than morphine in sciatica. Although the alkaloid in solution is not apparently absorbed by the skin, yet an ointment or oily solution removes the pain and allays the irritation in eczema, erysipelas, facial neuralgia, shingles, urticaria, and pruritus. The spray of an aqueous solution applied to inflamed mucous surfaces, as in hay-fever, influenza, coryza, bronchitis, spasmodic asthma, laryngitis, and pharyngitis, gives great relief by allaying irritation.

In dentistry it is employed to deaden the sensibility of exposed pulp. A strong solution in oil of cloves is a useful application in toothache or externally in neuralgia. Applied to the eye, *cocaine* acts as a rapid and powerful mydriatic, said to be more efficient than atropine, and readily controlled by physostigmine. A 4 per cent. solution produces maximum dilation in 1 hour, maintained for 3 or 4 hours, and passing off in about 24. It produces also constriction of small peripheral vessels, paralysis of accommodation, and enlargement of palpebral fissure. The effect is local only, being induced by paralysing the endings of the sensory nerves, and irritating the sympathetic nerves. Half a grain of pilocarpine nitrate added to 1 drachm of 4 per cent. solution prevents the disturbance of accommodation. Equal parts of an 8 per cent. solution and liq. atropinæ sulphatis effectively relieve all painful and inflamed conditions of the eye. The discs or lamels are used by oculists. They are placed in the eye and allowed to dissolve in the lachrymal secretion. A stronger kind are prepared containing $\frac{1}{4}$ grain of hydrochlorate for the extemporaneous production of hypodermic solutions. Tabloids of hydrochlorate of cocaine, containing $\frac{1}{10}$ to $\frac{1}{6}$ grain each, are also used for the same purpose. Internally, *cocaine* has been recommended in cases of great exhaustion, such as loss of blood, sunstroke, diarrhœa. It lessens the desire for sleep and the feeling of hunger, and in doses of $\frac{3}{4}$ to $1\frac{1}{2}$ grain quickly increases and sustains the physical powers of the body. It can be harmlessly employed for this purpose in long marches or mountain ascents. It also possesses aphrodisiac properties. It is a stomachic, giving relief when there is a distaste for food, and improving the condition of the stomach in atonic indigestion and nervous disorders. It has been much used as a remedy or preventive in sea-sickness. In doses of $\frac{1}{16}$ grain, every 2 or 3 hours, in aqueous solution it proved very successful. It is also useful in sickness from other causes, and in the vomiting of pregnancy. *Cocaine* is antagonistic to *morphine*, and has been successfully employed as a remedy for the "Morphia Crave." There is risk, however, that a "Coca Crave" may be developed. In one case the patient suffered from insomnia, and became the victim of hallucinations and jealousy, with ideas of persecution, accompanied by marked cachexia. When placed under restraint, the amount of *cocaine* was gradually diminished, and after 48 hours total abstention the delirium and hallucinations disappeared. The toxic effects of *cocaine* are mild and not cumulative. Lethal doses kill by asphyxia, the breathing becoming arrested, and the heart failing in diastole. There have been no fatal cases in the human subject. In a case of attempted suicide, 23 grains produced no serious effect. Inhalation of nitrite of amyl acts as an antidote. The coca alkaloids have been carefully tested physiologically by Stockman. *Cocamine* is a muscle poison, and acts on the nervous system in the same way as *cocaine*. When locally applied, its salts exert an anæsthetic action which is much less powerful than that of *cocaine*. *Cocamine* undoubtedly contributes to the physiological properties of coca.

Adulterations.—The process of gathering, drying, and preserving coca leaves is conducted with much care, and they are not subject to adulteration. They can be readily distinguished from other leaves by the characteristic curved lines on each side of the midrib. Some samples contain an admixture of portions of stems, twigs, and numerous yellow seed-capsules. Sometimes the leaves are found to have lost their fine green colour and become more or less brown, and the pleasant aroma of good leaves has given place to a musty smell. This is due to careless drying or bad preservation, which give rise to fermentation. It may sometimes be detected even in samples of a good green colour. As *cocaine* is very easily decomposed, all such samples should be rejected, as in all probability the alkaloid has been to a large extent, or even wholly, decomposed.

Linum Catharticum—Purging Flax—(*not official*).—A small indigenous plant, about 2 to 6 feet high, with small white flowers in a forked spreading panicle. It grows abundantly on dry pastures and heaths, and was formerly, but is not now, official. The dried and powdered herb, in doses of 1 drachm or 2 to 4 drachms, given as an infusion acts as a cathartic, and in smaller doses as a diuretic.

Nat. Ord. **OXALIDACEÆ**—The Wood-Sorrell Order—(*not official*). —Herbaceous or shrubby plants, inhabiting hot and temperate climates.

Oxalis acetosella—Wood Sorrell.—A small, indigenous, stemless plant, with ternate leaves, obcordate leaflets, and peduncles bearing one delicate, white, purple-veined flower. Common in woods and shady places. The leaves have an acid taste due to the presence of a crystalline compound of *oxalic acid* and *acid potassium oxalate*, popularly known as *salt of sorrel*, $KHC_2O_4,H_2C_2O_4,2H_2O$. Commercially, *salt of sorrel* and *oxalic acid* are now obtained by roasting wood sawdust with an alkali, when an alkaline oxalate is produced. It is interesting to note, however, that both the salt and the acid derive their names from this plant. *Salt of sorrel* has frequently led to poisoning, both intentionally and accidentally. The symptoms and treatment correspond with those given under *Oxalic Acid*, p. 51. Wood sorrel is refrigerant, antiscorbutic, and diuretic.

ZYGOPHYLLACEÆ—The Bean-Caper and Guaiacum Order.—Herbs, shrubs, or trees, inhabiting generally the warm regions of the globe beyond the tropics. The plants possess stimulant, alterative, diaphoretic, or anthelmintic properties.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
GUAIACUM OFFICINALE. GUAIACUM SANCTUM.	Heart-wood and resin.	St Domingo and Jamaica.

Guaiacum officinale and **Guaiacum sanctum**—Jamaica Guaiacum—Lignum Vitæ.

GUAIACI LIGNUM—*Guaiacum Wood.*—The heart-wood of *Guaiacum officinale*, Linn., or of *Guaiacum sanctum*, Linn. For use in pharmacy the wood should be deprived of its sap-wood, and the heart-wood reduced to the form of chips, raspings, or shavings.

Characters and Tests.—The chips, raspings, or shavings, as seen in pharmacies, are dark greenish-brown; their taste, when chewed for a short time, is acrid and somewhat aromatic; and their odour, when rubbed or heated, agreeable and faintly aromatic. Touched with nitric acid, or moderately heated in a solution of perchloride of mercury, a bluish-green colour is produced.[1]

[1] This coloration is due to oxidation of the resin in the wood. The specific gravity of the heart-wood is about 1·3, and consequently it sinks in water.

GUAIACI RESINA—*Guaiacum Resin.*—The resin obtained from the stem of the above plants, chiefly from the former. It is obtained partly as a natural exudation, or as the result of incisions made in the bark, or by placing a log horizontally on two upright stakes, making a deep incision in the middle of the log, and setting fire to it at both ends. The melted resin flows out from the incision abundantly, and is received in a calabash or other suitable vessel. It may also be obtained by boiling the chips in salt water and skimming off the resin as it rises.

Characters and Tests.—In roundish or somewhat oval tiers, or more commonly in large masses containing fragments of bark, wood, and other impurities; brownish or greenish-brown externally, and, when the surface has been rubbed and exposed to air and light, covered with a green powder. It is brittle, with a clean glassy fracture; thin splinters transparent, greenish-brown; powder greyish, becoming green by exposure. Odour faintly balsamic; and when chewed leaving an acrid sensation in the throat. A solution in rectified spirit strikes a clear blue colour when applied to the cut surface of a raw potato.[1]

[1] Due to oxidation of the resin, a result attributed to the gluten of the potato. Solution of chlorinated lime gives a similar reaction with the resin. The resin has a density of about 1·2, and melts at 85° C. It is readily soluble in alcohol, chloroform, ether, and solutions of caustic alkalies.

Dose.—In powder, bolus, electuary, or mucilage, 10 to 30 grains.

Active Principles.—*Guaiacum Wood* owes its medicinal properties to the *resin*, of which the heart-wood contains 26 per cent. *Guaiacum Resin* belongs to a class of substances to which the term "Resin" is applied. These substances are secondary products of vegetable metastasis, and are deposited in the plant tissues generally in cavities known as resin-passages. They consist, for the most part, of organic acids, insoluble in water but soluble in alcohol or ether, and combining with alkalies to form salts known as resin-soaps, which are soluble in water. When subjected to dry distillation, resins yield distillates consisting principally of liquid hydrocarbons. They differ from *gum-resins* in not forming an emulsion with water. *Guaiacum Resin*, according to Hadelich, contains 70 per cent. of *Guaiaconic Acid*, $C_{38}H_{40}O_{10}$, a light brown amorphous substance fusing at 100° C., insoluble in water or benzol, soluble in alcohol, ether, and chloroform. It is the constituent which gives the characteristic blue reaction of guaiacum with oxidising agents. The *resin* also contains 10·5 per cent. of a crystalline principle, *Guaiaretic Acid*, $C_{20}H_{26}O_4$, insoluble in water, but soluble in benzol, alcohol, ether, and chloroform; 10 per cent. of a neutral resin, *Guaiac Beta-Resin;* 3·4 per cent. of *gum;* and small percentages of *Guaiacic Acid*, $C_{12}H_{16}O_6$, in colourless needles; and *Guaiac-Yellow*, the colouring matter of the *resin*, in pale yellow octohedra. The distillates obtained from the *resin* by dry distillation are of considerable chemical interest. At 118° C. a colourless neutral hydrocarbon, *Guaiacene*, C_5H_8O, passes over. At 205°–210° C., *Guaiacol* (methyl-ether of pyrocatechin), $C_6H_4.OCH_3.OH$, and *Kreosol*, $C_6H_3.OH(CH_3)_2$, pass over. At a higher temperature pearly plates of *Pyroguaiacin*, $C_{38}H_{44}O_6$., sublime.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoct. Sarsæ Co.	Wood.	$\frac{1}{4}$ oz. to 1 pint.	2 to 10 oz.
Mistura Guaiaci.	Resin.	11 grs. to 1 oz.	$\frac{1}{2}$ to 2 oz.
Pil. Hyd. Subchlor. Co.	"	1 in $2\frac{1}{2}$.	5 to 10 grains.
Tinct. Guaiaci Ammoniata.	"	88 grs. to 1 oz.	$\frac{1}{2}$ to 1 drachm.

MISTURA GUAIACI—Guaiac Mixture.—*Take of guaiacum resin, refined sugar, of each* $\frac{1}{2}$ *ounce; gum acacia,*[1] *powdered,* $\frac{1}{4}$ *ounce; cinnamon water,* 1 *pint. Triturate the guaiacum with the sugar and the gum, adding gradually the cinnamon water.*

[1] Gum acacia does not make a good emulsion, as it forms a compact sediment with the resin, difficult to shake up. Squire recommends a fourth of the quantity of Tragacanth instead.

TINCTURA GUAIACI AMMONIATA—Ammoniated Tincture of Guaiac.—*Take of guaiacum resin, in powder,* 4 *ounces; aromatic spirit of ammonia, a sufficiency. Macerate the guaiacum in* 15 *fluid ounces of the aromatic spirit of ammonia for seven days in a well-closed vessel, with occasional agitation, and filter; then add sufficient aromatic spirit of ammonia to make* 1 *pint.*

LITHII GUAIACAS—Guaiacate of Lithium—(*not official*).—A scale preparation, containing 1 part of lithia to 3 parts of guaiacum resin. Prepared by digesting the resin in an aqueous solution of lithia, decanting, evaporating, and scaling.

Dose.—5 grains twice daily.

Therapeutics.—Guaiacum acts as a stimulant, diaphoretic, and alterative, and it also increases the discharge of urine when its action upon the skin is not facilitated. In over-doses it produces burning in the throat, vomiting, purging, and febrile disturbance; and even in moderate doses its administration is occasionally followed by slight salivation or a cutaneous eruption. The cases in which it has been most useful are—chronic rheumatism, atonic gout, cynanche tonsillaris, syphilitic eruptions and pains, amenorrhœa, hyper-secretions of mucous membranes, &c. It is suitable in the cases of old and debilitated persons, and is contra-indicated in acute inflammatory states of the system. The wood is much milder in its action than the resin, but it is now scarcely ever employed except as an ingredient of the compound decoction of sarsaparilla. A lozenge of black currant paste containing 2 grains resin of guaiacum is employed as a specific in arresting crescent inflammation of the tonsils. Tincture of guaiacum is employed for the detection of blood stains. It strikes a blue colour with the red colouring matter of blood when employed along with an ethereal solution of peroxide of hydrogen. *Guaiacol*, sp. gr. 1·117, boiling-point 200° C., is useful in the incipient stages of phthisis, and rarely disagrees. A convenient form for administration is *Guaicol* 1, water 180, rectified spirit 20; dose, 1 to 4 drachms in water twice or thrice daily after meals, or it may be given in cod-liver oil, which disguises the taste. As already stated, *Guaiacol* is one of the products of the destructive distillation of guaiacum resin, but it is more economically obtained from beech creasote, which yields from 60 to 90 per cent.

Adulterations.—Guaiacum wood is not much subject to adulteration. Sometimes there is too much sap-wood present, and this is detected by the light colour of the sample and its deficiency in resin. Schultz examined eleven samples purchased in the United States, and only one contained any resin. He suggests that possibly the chips had been already exhausted of resin. *Guaiacum resin* is not often adulterated. Pine resin is sometimes present, and may be detected either by the terebinthinate odour evolved when heated, or by treatment with hot oil of turpentine, which dissolves the pine resin but not the guaiacum resin. It is also sometimes contaminated to the extent of 12 to 15 per cent. with pieces of wood and bark, sand, and other impurities, owing to carelessness in collection. A good sample should dissolve in rectified spirit to the extent of about 90 per cent.

Nat. Ord. **RUTACEÆ**—The Rue Order.—Trees, shrubs, or herbs inhabiting the southern part of the temperate zone. The plants have a peculiar penetrating odour and bitter taste, and are employed medicinally as antispasmodics, tonics, febrifuges, or diurectics.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Galipea Cusparia.	Dried bark.	Tropical So. America.
Ruta graveoleus.	Essential oil.	South of Europe.
Barosma { betulina. crenulata. serratifolia. }	Dried leaves.	Cape of Good Hope.
Pilocarpus pennatifolius.	Dried leaves.	Brazil.

Galipea Cusparia—Cusparia, Angustura, or Carony Bark Tree.

CUSPARIÆ CORTEX—CUSPARIA OR ANGUSTURA BARK.—The dried bark of *Galipea Cusparia*, St Hilaire.

Characters and Tests.—In flattish or curved pieces, or in quills, 6 inches or less in length; the bark itself commonly not more than ⅛ inch thick, and obliquely cut on its inner edge. Coated externally with a yellowish-grey[1] mottled corkey layer, which may usually be scraped off with the nail, the exposed surface then presenting a dark brown resinous appearance; inner surface light brown,[1] flaky, and occasionally with strips of wood attached; fracture short and resinous,[1] and exhibiting, more especially when examined by a magnifying lens, numerous white points or lines.[2] Taste bitter, and somewhat aromatic;[1] odour musty and disagreeable.[3] The fractured surface touched with nitric acid does not become of an arterial blood-red colour.[4]

[1] False Brazilian Angustura Bark, *Esenbeckia febrifuga*, is *grey* externally, *dark* brown internally, has a distinctly *fibrous* fracture, and is entirely *destitute* of aromatic properties. [2] Due to deposits of calcium oxalate. [3] Reminds one of soap-suds. [4] Distinguishes it from *strychnos* bark, the *brucine* of which strikes a deep red colour with nitric acid. A section of cusparia bark under the microscope shows numerous cells filled with volatile oil or a yellowish resin.

Active Principles.—The aromatic properties of cusparia are due to a *volatile oil*, of which the bark yields 0·19 per cent. It has the formula $C_{13}H_{24}O$, and boiling-point 266°·1 C., and is a mixture of a hydrocarbon and an oxygenated oil. The bark is said to owe its bitterness to a neutral crystalline principle, *Cusparin*, which is said to be present to the extent of 1·3 per cent. Oberlin and Schlagdenhauffen failed to find this principle, but separated an alkaloid, *Angosturine*, $C_{10}H_{40}O_{14}$. More recently Kœrner and Bœhringer obtained from 0·8 to 1 per cent. of total alkaloids, consisting of the alkaloids *Cusparine*, $C_{19}H_{17}NO_3$, *Gallipene*, $C_{20}H_{21}NO_3$, and a third alkaloid.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Infusum.	Dried bark.	1 in 20.	1 to 2 ounces.

INFUSUM CUSPARIÆ—INFUSION OF CUSPARIA.—*Take of Cusparia, in* No. 40 *powder,* ½ *ounce; distilled water at* 120° F.(48°·9 C.)[1] 10 *fluid ounces. Infuse in a covered vessel for* 1 *hour, and strain.*

[1] A higher temperature would cause considerable loss of aromatic

properties from volatilisation of the essential oil. There is less risk of this now that the time for infusion has been reduced from 2 hours to 1 hour.

Therapeutics.—Cusparia acts as a stimulant, aromatic, non-astringent tonic, and as a febrifuge. It is administered in atonic dyspepsia, in convalescence from acute diseases, in the latter stages of diarrhœa and dysentery, &c.; and in tropical South America it is highly esteemed as a febrifuge in intermittent and malignant bilious fevers In large doses it causes nausea and purging.

Adulterations and Substitutions.—In 1804 a consignment of *Strychnos Nux Vomica* bark from India was accidentally mistaken for Cusparia, and caused some accidents and great alarm. *Strychnos* bark is detected by the nitric acid test, but such a substitution is never met with now. The bark of *Esenbeckia* or *Evodia febrifuga* has been substituted for true Cusparia. It is in longer pieces, 8 to 10 inches, and thinner, $\frac{1}{16}$ inch, of a persistently bitter taste and destitute of aroma.

Ruta graveolens—Common or Garden Rue.

Botany.—A small, branching under-shrub, 2 to 3 feet high, with a strong, disagreeable odour. *Stem*, straight, dull-greenish, quite smooth. *Leaves*, alternate bluish-green; leaflets thickish, tapering towards the bases, dotted. *Flowers*, in a terminal corymb, yellow. *Fruit*, roundish, warty, four or five lobed. *Seeds*, dotted. *Habitat*, South of Europe; cultivated in gardens.

Oleum Rutæ—*Oil of Rue.*—The oil distilled from the fresh herb of *Ruta graveoleus*, Linn.

Characters.—Pale yellow when recent, becoming brown by age, with a strong disagreeable odour and a bitter acrid taste. Specific gravity about 0·880, boiling-point 230° C., soluble in an equal weight of alcohol. It consists mainly of an oxidised constituent, *methyl-nonyl-ketone*, $CH_3.CO.C_9H_{19}$. The fresh herb yields from 0·28 to 0·50 per cent., the best yield being obtained when the fruits are fully formed. The seeds yield 1 per cent.

Dose.—1 to 4 minims.

Therapeutics.—Rue acts as a stimulating antispasmodic, and in over-doses as a narcotico-irritant. It is sometimes resorted to for the criminal purpose of procuring abortion, and was formerly much employed as an emmenagogue. Externally, the oil of rue acts as an irritant and vesicant. The preparations of rue have been recommended in amenorrhœa, chlorosis, hysteria, epilepsy, infantile convulsions, worms, &c.; but it is now chiefly used in the flatulent colic of children, administered either by the stomach or as an enema.

Barosma betulina, Barosma crenulata, and **Barosma serratifolia**—Buchu—Bucco—Buku.

Buchu Folia—*Buchu Leaves.*—The dried leaves of—(1) *Barosma betulina*, Bart. and Wendl. (2) *Barosma crenulata*, Hook. (3) *Barosma serratifolia*, Willd.

Characters.—Smooth, serrate, somewhat dentate or crenate, and marked on the margins, and especially on their under surface, with oil glands. Their colour is dull yellowish-green; odour strong, penetrating and peculiar; taste aromatic, bitterish, and mint-like. (1) From $\frac{1}{2}$ to $\frac{3}{4}$ inch long, cuneate or rhomboid-obovate, serrate-dentate, apex very blunt and usually recurved; texture more cartilaginous than in the other species. (2) From $\frac{3}{4}$ to about $1\frac{1}{4}$ inch long, thickish, oval-oblong or rhomboid-oval, somewhat blunt at the apex, narrowed at the base into a distinct petiole, finely serrate or crenate-serrate. (3) From 1 to $1\frac{1}{2}$ inch long, linear lanceolate, equally tapering to each end, actual apex truncate, sharply and closely serrate; texture thinner than in the other species.

Active Principles.—The leaves probably owe their virtues to the *volatile oil*, of which those of *B. betulina* yield 1·45 per cent., and those of *B. serratifolia* about 1 per cent. Notwithstanding this, the latter are more highly valued in the market. *B. crenulata* leaves yield 1·6 per cent., but are not commonly met with in commerce. The *oil* has an odour closely resembling peppermint, and when cooled deposits crystalline *Barosma Camphor* or *Diosphenol*, which has a pure peppermint odour. The *oil* freed from *camphor* boils at 204° C., rising to 26° C., and has the formula $C_{10}H_{18}O$. The leaves also contain a green, *bitter resinous matter*, *B. betulina* yielding 4·25 per cent., *B. crenulata* 3·75 per cent., and *B. serratifolia* 3·45 per cent. The so-called bitter substance, *Diosmin* of Landerer is of doubtful existence, but Spica applied the name *Diosmin* to a substance extracted by alcohol from the residue after extraction of the *oil*. The leaves, when treated with water, yield abundance of *mucilage* by solution of the cell walls as in quince and linseed.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Dried leaves.	1 in 20.	1 to 4 ounces.
Tinctura.	„	1 in 8.	1 to 2 drachms.

INFUSUM BUCHU—INFUSION OF BUCHU.—*Take of Buchu leaves, bruised,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

TINCTURA BUCHU—TINCTURE OF BUCHU.—*Take of Buchu leaves, in No.* 20 *powder,* 2½ *ounces; proof spirit,* 1 *pint.*

Made by the same process as tincture of aconite.

Therapeutics.—Buchu acts as an aromatic stimulant, tonic, diaphoretic, and diuretic, operating beneficially upon the mucous membrane of the alimentary canal, and especially so upon the urinary passages. It is chiefly employed in chronic affections of the genito-urinary organs in which there is considerable mucous discharge, associated with more or less of general debility and dyspepsia. It should be continued for some time, and be given in large doses with alkalies, tincture of hyoscyamus, &c., according to circumstances.

Adulterations or Substitutions.—Parcels of the leaves are frequently more or less mixed with the flowers, fruits, and stalks of the same plants. The leaves of *Empleurum serrulatum* are frequently imported and sold as Buchu. They closely resemble the leaves of *B. serratifolia*, but are longer, narrower, terminating in an *acute* point *without* an oil-gland. The true *B. serratifolia* leaves have a *truncate* apex *always furnished* with an oil-gland.

Pilocarpus pennatifolius—Pernambuco Jaborandi.

PILOCARPI FOLIOLA OF JABORANDI—*Jaborandi*—The dried leaflets of *Pilocarpus pennatifolius*, Lemaire. The leaflets of *Pilocarpus selloanus*, Engler, are also imported under the name of Jaborandi. They are said to be much less active than the former, from which they differ in being quite smooth on both surfaces, the leaflets of *P. pennatifolius* being slightly hairy on the under surface, especially on the nerves.

Characters.—Leaflets very shortly stalked, usually 4 inches or more in length, oval-oblong or oblong-lanceolate. Somewhat unequal at the base, obtuse and emarginate, slightly revolute and entire at the margins, coriaceous. Upper surface glabrous, except when young; dull green; under surface paler, often somewhat hairy, with a very prominent midrib, and seen to be marked irregularly all over with pellucid dots[1] when held against the light. Odour when bruised slightly, aromatic;[2] taste on chewing slightly bitter and aromatic at first, subsequently pungent and increasing the flow of saliva.

[1] Oil glands. [2] Odour very like *Ruta graveolens*.

Dose of the Powder.—5 to 60 grains.

2 A

Active Principles.—The leaves yield rather less than 0·5 per cent. of *Pilocarpine*, $C_{11}H_{16}N_2O_2$, a colourless, syrupy, liquid, odourless alkaloid, forming crystalline salts with acids. Three other alkaloids, *Jaborine*, *Pilocarpidine*, and *Jaboridine* are said to have been separated from the leaves, but they probably result from decomposition of *Pilocarpine*. *Pilocarpine* and *Pilocarpidine* have a similar physiological action, and are antagonistic to *Jaborine* and *Jaboridine*. The leaves also yield 0·4 per cent. of *volatile oil*, sp. gr. 0·875, boiling point between 180° and 290° C., the fraction above 260° C. solidifying on cooling. *Pilocarpine* has been prepared synthetically from *pyridine*.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Dried leaves.	...	2 to 10 grains.
Infusum.	"	1 in 20	1 to 2 ounces.
Tinctura.	"	1 in 4	$\frac{1}{2}$ to 1 drachm.
Pilocarpinæ Nitras.	"	...	$\frac{1}{20}$ to $\frac{1}{2}$ grain.

EXTRACTUM JABORANDI—Extract of Jaborandi.—*Take of Jaborandi, in No.* 40 *powder*, 1 *pound; proof spirit*, 2 *pints; water, a sufficiency. Mix the Jaborandi with the proof spirit; macerate in a closed vessel forty-eight hours; transfer to a percolator, and when the fluid ceases to pass continue the percolation with water till* 2 *pints of liquid have been collected. Evaporate the percolated liquid to a suitable consistence.*

INFUSUM JABORANDI—Infusion of Jaborandi.—*Take of Jaborandi, cut small*, $\frac{1}{2}$ *an ounce; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

TINCTURA JABORANDI—Tincture of Jaborandi.—*Take of Jaborandi, in No.* 40 *powder*, 5 *ounces; proof spirit*, 1 *pint.*

Made by the same process as tincture of aconite.

PILOCARPINÆ NITRAS — Nitrate of Pilocarpine — $C_{11}H_{16}N_2O_2,HNO_3$.—Prepared from the extract by a process similar to that employed for the separation of *cocaine*, substituting ammonia for carbonate of sodium as a precipitant, chloroform for ether as a solvent, and neutralising with nitric acid instead of hydrochloric acid. The free alkaloid may be readily prepared by exhausting the leaves with 80 per cent. alcohol, containing 8 grammes hydrochloric acid to the litre, distilling off the alcohol, adding water, and proceeding as in Squibb's process for *cocaine*, using ammonia as a precipitant and Chloroform for washing out. The alkaloid is obtained as a viscous mass, slightly soluble in water, freely soluble in alcohol, chloroform, and ether.

Character and Tests.—In a white crystalline powder or acicular crystals;[1] soluble in 8 or 9 parts of water at common temperatures; slightly soluble in cold (1 in 50); freely soluble in hot rectified spirit.[2] Strong sulphuric acid forms with it a yellowish solution which, on the addition of potassium bichromate, gradually acquires an emerald-green colour. It causes contraction of the pupil of the eye. It leaves no ash when burned with free access of air.

[1] It may also be obtained in large, white, prismatic crystals. [2] The hydrochlorate, $C_{11}H_{16}N_2O_2$, HCL, is deliquescent and freely soluble in water and rectified spirit. The nitrate is insoluble, and the hydrochlorate freely soluble in chloroform.

Therapeutics.—Jaborandi stimulates the centres of the salivary and sweat glands as well as the peripheral terminations of the secreting nerves. It also stimulates the nerves supplying involuntary muscular fibre, as noticed in the eye, intestine, heart and vessels, bladder, uterus, and spleen. By stimulating the terminations of the third nerve in the eye, it causes contraction of the pupil and spasm of accommodation, and indistinct vision; after this passes off the pupil may dilate. By stimulating the intestinal ganglia it causes increased peristalsis. It diminishes arterial tension, and causes vomiting from gastric irritation. From its stimulating action on the secreting nerves it produces enormous secretion of saliva from the submaxillary, sublingual, and parotid glands, and enormous secretion of sweat from the sweat glands, commencing either from the face or at the point of subcutaneous injection, preceded by flushing of the face, ears, and neck, and extending over the whole surface of the body. It increases also, although to a less extent, the secretions from the lachrymal glands, of wax from the ears, and of mucus from the nasal, bronchial, and gastric mucous membranes —probably also the secretion from the intestinal glands, and of the urine from the kidneys. The secretion of milk is also sometimes increased, but it does not affect the biliary secretion. The temperature rises during the shivering, and falls during the sweating stage. The sweating usually lasts for two or three hours, and is so copious that the body loses one or two pounds, and sometimes as many as eight, from it and the salivation together. The sweating is followed by a feeling of languor and thirst. *Pilocarpine* is excreted unchanged by the urine but is not present in the saliva.

Injurious effects sometimes caused by it are dimness of vision, vomiting, sudden collapse, swelling of the salivary glands and tonsils, hiccough, diminished secretion of urine, albuminuria, strangury, bleeding from the vagina, and anticipation of the menstrual flux. *Pilocarpine*, to which these effects are due, antagonises atropine very completely, preventing its action if administered before it and removing its effects if given after it. Sudden collapse should therefore be treated by the subcutaneous injection of atropine. The nausea and vomiting are relieved by morphine. *Jaborine* has an action similar to that of atropine, and antagonistic to that of *pilocarpine;* but the action of the leaves is that of *pilocarpine.* On account of their action Jaborandi and its preparations are employed chiefly in dropsy and in uræmia depending on disease of the kidneys, and in pleural and peritoneal effusions. In dropsy from heart disease it must be employed with great caution. In dropsy depending on renal disease it eliminates urea as well as water both by the sweat and saliva, and it probably is due to this action that *pilocarpine* cuts short uræmic convulsions. In puerperal eclampsia it is not so successful. It is sometimes also given to eliminate from the system lead, mercury, and arsenic in chronic poisoning from these metals. In some skin diseases, as prurigo, chronic urticaria, and baldness it is useful. In ophthalmic practice it is employed in chronic catarrh, in intraocular hæmorrhage, in separation of the retina, and, instead of physostigmine, in glaucoma. As its action is peripheral rather than central, it affects the eye more powerfully when applied locally than when taken internally. Children are less affected by this drug than adults, salivation being generally absent. In fatty heart and impeded pulmonary circulation from valvular disease, emphysema, or pleurisy, if given at all, it must be administered cautiously, and the patient watched. It may be given with alcoholic stimulants, and atropine should be at hand for subcutaneous injection if necessary.

Adulterations and Substitutions.—The native name Jaborandi is applied to at least seven totally distinct plants, all possessing sialogogue and diaphoretic properties, and mostly belonging to the natural order *Piperaceæ;* but the official characters of *Pilocarpus* leaves are quite sufficient to prevent mistake. The *Piper* leaves are brighter green in colour, much thinner, and not pinnate.

Nat. Ord. **AURANTIACEÆ**—The Orange Order.—Trees or shrubs, chiefly East Indian plants. The pulp of the fruit has an acid and saccharine taste; the leaves and rind contain a volatile, fragrant oil, which is used in flavouring, in perfumery, and for other purposes. The rind also contains a tonic principle.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
Citrus Vulgaris.	Peel and Flowers.	South of Europe.
Citrus Aurantium.	Flowers.	" "
Citrus Limonum.	Peel and Juice.	" "
Citrus Bergamia.	Juice.	South Europe and West Indies.
Ægle Marmelos.	Dried, half-ripe Fruit.	Malabar and Coromandel.

Citrus vulgaris—Bitter Orange—Seville Orange—Bigarade Orange—Marmalade Orange.

Citrus Aurantium—Sweet Orange—China Orange—Portugal Orange.

Aurantii Cortex—Aurantii Pericarpium—*Bitter Orange Peel.*—The dried outer part of the rind of *Citrus vulgaris*, Risso (*Citrus bigaradia*, Duhamel).

Characters.—In thin pieces, or in curled bands or strips, glandular, and of a deep orange-red colour externally, and white within from a portion of the inner spongy part of the rind not having been removed. It has an aromatic, bitter taste, and pleasant aromatic odour.

Aurantii Fructus— *Bitter Orange Fruit.*—The ripe fruit of *Citrus vulgaris*, Risso.

Characters.—Globular, somewhat compressed at the two ends; about the size of the sweet orange, but the pericarp is rougher, darker in colour, being deep orange-red or red; the pulp very bitter and sour, and the rind more aromatic and very bitter.

Aurantii Flores.—The partly expanded fresh flowers of the Bitter Orange tree, *Citrus vulgaris*, Risso; and of the Sweet Orange tree, *Citrus Aurantium*, Risso.

Active Principles.—The aromatic constituent of orange peel is the *volatile oil*, sp. gr. 0·83 to 0·85, boiling point 175° C. The commercial *oil*, which is obtained by the sponge or *écuelle* process (*see* Lemon) consists mainly (97·2 per cent.) of a hydrocarbon or terpene, *Hesperidene*, $C_{10}H_{16}$, boiling at 178° C., a small quantity of an *oxidised* *terpene*, $C_{10}H_{16}O$, boiling at 220° C., and a non-volatile soft *resin*, $C_{20}H_{30}O_3$. The bitter and tonic properties of the peel have been attributed to a glucoside, *Hesperidin*, $C_{22}H_{26}O_{12}$, which is present to the extent of 0·1 to 0·6 per cent., but it is probably due chiefly to an extremely bitter isomeric glucoside, *Aurantiamarin*, $C_{22}H_{26}O_{12}$, of which the peel yields 1·5 to 2·5 per cent. *Hesperidin* is insoluble in water when alone, but dissolves along with *Aurantiamarin*, which is freely soluble in water. The peel also yields 0·4 to 3 per cent. of *Isohesperidin*, $C_{22}H_{26}O_{12}$, also isomeric with *Hesperidin*, but more soluble; 0·05 to 0·1 per cent. of a feeble crystalline tasteless *acid*, $C_{22}H_{28}O_7$; 0·1 per cent. of resinous, bitter *Aurantiamaric Acid*, $C_{10}H_{12}O_4$, and another resinous, bitter, and extremely acrid *acid*. The odour of the flowers is due to a *volatile oil* known in commerce as *Oil of Neroli*. The fresh flowers of the Bitter Orange tree yield 0·6 to 0·7 per cent.; the flowers of the Sweet Orange tree yield only half as much. Commercial *Oil of Neroli* frequently contains volatile oil of orange leaves (*Essence de Petit Grain*) and volatile oil of ergamot.

Official Preparations.

Name	Part Used.	Strength.	Dose.
Infusum.	Dried peel.	1 in 20	1 to 2 ounces.
Infusum Comp.	„	1 in 40	1 to 2 ounces.
Syrupus.	„	1 in 80	1 drachm.
Tinctura.	„	1 in 10	1 to 2 drachms.
Tinctura recentis.	Fresh peel.	3 in 10	1 to 2 drachms.
Vinum.	„	...	...
Aqua floris.	Fresh flowers.	...	...
Syrupus floris.	„	...	1 drachm.

INFUSUM AURANTII—Infusion of Orange Peel.—*Take of bitter orange peel, cut small,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for fifteen minutes, and strain.*

INFUSUM AURANTII COMPOSITUM—Compound Infusion of Orange Peel.—*Take of bitter orange peel, cut small,* ¼ *ounce; fresh lemon peel, cut small,* 56 *grains; cloves, bruised,* 28 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for fifteen minutes, and strain.*

SYRUPUS AURANTII—Syrup of Orange Peel.—*Take of tincture of orange peel,* 1 *fluid ounce; syrup,* 7 *fluid ounces. Mix.*

The specific gravity should be about 1·282.

TINCTURA AURANTII—TINCTURE OF ORANGE PEEL.—*Take of bitter orange peel, cut small and bruised, 2 ounces; proof spirit, 1 pint. Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, and filter, and add sufficient proof spirit to make 1 pint.*

The above process is known as simple maceration.

TINCTURA AURANTII RECENTIS—TINCTURE OF FRESH ORANGE PEEL.—*Take of bitter orange and rectified spirit, of each a sufficiency. Carefully cut from the orange the coloured part of the rind in thin slices, and macerate 6 ounces of this in 18 fluid ounces of the spirit for a week, with frequent agitation. Then pour off the liquid, press the dregs, mix the liquid products, and filter; finally, add sufficient spirit to make 1 pint.*

VINUM AURANTII—ORANGE WINE.—Wine made in Britain, by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added.

Characters and Tests.—A vinous liquid, having a golden sherry colour, and a taste and aroma derived from the bitter orange peel. It contains 10 to 12 per cent. of alcohol, and is but slightly acid to test-paper.

AQUA AURANTII FLORIS—ORANGE-FLOWER WATER.—Water distilled from the flowers of *Citrus vulgaris* and *Citrus aurantium*, the Bitter and Sweet Orange trees, prepared mostly in France. The Orange-flower Water of commerce is usually three times the strength of that employed in former years.

Characters and Tests.—Colourless or with a slight greenish-yellow tint; odour very fragrant; taste bitter. Not coloured by sulphuretted hydrogen.[1]

[1] Indicating absence of copper and lead.

SYRUPUS AURANTII FLORIS—SYRUP OF ORANGE FLOWER.—*Take of orange-flower water, 8 fluid ounces; refined sugar, 3 pounds; distilled water, 16 fluid ounces, or a sufficiency. Dissolve the sugar in the distilled water by means of heat; strain, and when nearly cold add the orange-flower water, with a sufficient quantity of distilled water, if necessary, to make the product 4½ pounds. The specific gravity should be* 1·330.

ELIXIR SIMPLEX—SIMPLE ELIXIR (B.P.C.)—(*not official*).—*Take of oil of bitter orange, 30 minims; rectified spirit, 6 fluid ounces; dissolve, and add cinnamon water and syrup, of each 7 fluid ounces. Mix. Filter through paper moistened with proof spirit and well sprinkled with kaolin, returning the first portions of filtrate until it passes through bright.*

Dose.—20 to 60 minims.

Therapeutics.—Orange peel and its preparations are commonly employed as aromatic, tonic, and stomachic, or flavouring adjuncts to, or vehicles for, other remedies, their activity depending on the bitter principles and the volatile oil, in addition to which the rind contains a little tannic acid. The distilled water of the flowers is stimulant and antispasmodic. Added to preparations of iron it is often beneficial in enabling anæmic patients to bear them, whereas they cannot take chalybeate preparations administered alone, on account of their too great stimulant action. Orange juice, either directly from the fruit, or diluted with water and sweetened with sugar, is given as a refrigerant in febrile and inflammatory cases. It contains *Citric Acid.*

Adulterations or Substitutions.—Foreign dried orange peel is less valued than that dried in England. It is deficient in aroma. The peel of Sweet Orange may be detected by its paler and less rough surface and much less bitter taste. Lemon peel may be accidentally substituted for orange peel. The best distinction is the characteristic odour. It is also much paler in colour. *Essential oil of orange* spoils by keeping. It should be free of terebinthinate odour. *Oil of Neroli* is frequently adulterated with oil of orange leaves and oil of bergamot. Orange-flower water may contain lead or copper from the tinned copper vessels in which it is imported. The water sometimes also becomes turbid and acquires a musty odour, due probably to the presence of some micro-organism.

Citrus Limonum—Lemon.

LIMONIS CORTEX—*Lemon Peel.*—The outer part of the rind or pericarp of *Citrus limonum*, Risso.

Characters.—Pale yellow, and more or less rough on the outer surface from the presence of glands containing volatile oil, which are imbedded in the tissue beneath; and having but a very small amount of the white spongy portion of the rind on its inner surface. Odour strong, peculiar, and fragrant; taste warm, aromatic, and bitter.

LIMONIS OLEUM—*Oil of Lemon.*—A volatile oil obtained by mechanical means from fresh lemon peel.

Characters.—Pale yellow, with a fragrant odour,[1] and a warm bitterish aromatic taste.

[1] The distilled oil is much less fragrant. Samples having a terebinthinate odour should be rejected as probably adulterated.

LIMONIS SUCCUS—*Lemon Juice.*—The freshly expressed juice of the ripe fruit of *Citrus limonum*, Risso.

Characters and Tests.—A slightly turbid, yellowish liquid, with a sharp acid taste. Specific gravity, 1·035 to 1·045. One fluid ounce should contain from 36 to 46 grains of citric acid.[1]

Dose.—2 drachms to 1 ounce.

[1] Williams found 30 to 36 grains citric acid per ounce in juice pressed in winter, and 20 to 30 grains in juice pressed in summer. The largest yield, 35·6 grains, was obtained in November.

Active Principles.—The most important constituent of lemon peel is the *volatile oil*, which closely resembles that of bitter orange. It has a specific gravity of 0·850, and consists mainly of a terpene, $C_{10}H_{16}$, boiling point, 176° C. It contains also a small percentage of a second isomeric terpene, also *cymene*, $C_{10}H_{14}$, and a compound acetic ether, $C_2H_3O_2(C_{10}H_{17}O)$. The oil is obtained either by the *sponge process* or by the *écuelle process*. By the former the peel is pressed against a sponge so as to rupture the oil-glands. The oil is absorbed by the sponge, wrung out into a dish, and allowed to stand till the oil clears and is poured off. By the latter process the lemon is pressed and rotated against numerous short spikes in the bottom of a saucer-like metallic dish, having a tubular receptacle in the centre, into which the oil flows from the punctured oil-glands. This is poured into a dish and clarified as in the first process. 400 lemons yield from 9 to 14 ounces of oil. The oil is liable to decomposition, and is sometimes preserved by adding 5 per cent. of alcohol, allowing to stand, and pouring off the clear oil from the sediment which falls. The oil is freely soluble in absolute alcohol and sparingly in rectified spirit. The peel also contains the glucoside *Hesperidin*, $C_{22}H_{26}O_{12}$, which gives a blackish-brown reaction with ferric chloride. Lemon juice contains from 5 to 8 per cent. of *citric acid*, 3 to 4 per cent. of *gum* and *sugar*, and 2 to 3 per cent. of inorganic salts.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Oleum.	Fresh peel.	...	1 to 4 minims.
Syrupus.	Fresh peel and juice.	2 in 41 20 in 41	1 to 2 drachms.
Tinctura.	Fresh peel.	1 in 8	½ to 2 drachms.

SYRUPUS LIMONIS—SYRUP OF LEMON.—*Take of fresh lemon peel*, 2 *ounces; lemon juice, strained*, 1 *pint; refined sugar*, 2¼ *pounds. Heat the lemon juice to the boiling point, and, having put it into a* *covered vessel with the lemon peel, let them stand until they are cold, then filter and dissolve the sugar in the filtered liquid with a gentle heat. The product should weigh* 3½ *pounds, and should have the specific gravity* 1·34.

TINCTURA LIMONIS—Tincture of Lemon Peel.—*Take of fresh lemon peel, cut small,* 2½ *ounces ; proof spirit,* 1 *pint.*

Made by the same process as tincture of orange.

Therapeutics.—Lemon peel and the preparations made from it are employed as adjuncts to other medicines, affording an agreeable flavour and a somewhat aromatic, tonic, and stomachic effect. Oil of lemons has been employed as a topical stimulant application to the eye in rheumatic and scrofulous ophthalmia, and it may be taken internally as a carminative, in doses of two or three drops, either added to other medicines or dropped upon sugar. Lemon juice has been given in the form of a drink, as a sedative and refrigerant, in febrile and inflammatory diseases. In acute rheumatism it has been recommended by Dr Owen Rees on the supposition that it eliminates such elements as tend to produce uric acid in the form of urea and carbonic acid by supplying them with oxygen. This is not, however, borne out by the results of clinical experience, but it is sometimes useful if neutralised with potash or soda when it is eliminated as a carbonate, rendering the urine alkaline. In the form of effervescing lemonade, or an effervescing draught, it is given to allay vomiting. It is given as an antiscorbutic in scurvy, both as a prophylactic and curative agent, and is equalled by no other remedy except a liberal supply of pure vegetables of the *cruciferæ.* On long voyages 1 to 1½ ounce daily is a prophylactic dose, while as a curative agent 4 to 6 ounces daily will be required. It is given as an antidote in narcotic poisoning, and in poisoning with caustic alkalies. It has also been given in acute dysentery and diarrhœa, in dropsical affections, &c.

Adulterations and Substitutions.—Oil of lemon is frequently adulterated either with the very inferior distilled oil, or with oil of turpentine. These are best detected by the terebinthinate odour of the sample. Alcohol is sometimes present, and may be detected by placing the oil in a dry test-tube, dusting a little powdered fuchsine in the inside of the tube above the oil, which is now heated to boiling. If alcohol is absent the fuchsine is unchanged, but 0·1 per cent. of alcohol causes the formation of a red edge round each particle of fuchsine. Lemon juice is very prone to decomposition. It may be preserved by heating to 150° F., and setting aside in completely filled corked bottles. Ten per cent. of strong brandy is added to that supplied to the British Navy. Spurious lemon juice is sometimes prepared from citric acid, and flavoured with oil of lemon. Much of the so-called lemon juice of commerce is really lime juice (see *Citrus Bergamia*). An aqueous solution of tartaric acid, with a little sulphuric acid, has been fraudulently supplied as lemon juice. It can be detected by applying the tests for tartaric and sulphuric acids.

Citrus Bergamia—Citrus Limetta—Bergamot—The Lime.

LIMETTÆ SUCCUS—*Lime Juice.*—The freshly expressed juice of the ripe fruit of *Citrus Bergamia*, Risso (*Citrus Limetta*, D'C.).

Characters.—Similar to lemon juice, for which it is frequently substituted. It is one of the official sources of citric acid, of which it is said to contain a larger percentage than lemon juice.

BERGAMIÆ OLEUM.—*Oil or Essence of Bergamot*—(*not official*).

Essence of Bergamot of commerce is obtained from the rind of the above fruit in the same way as oil of lemon. It has an agreeable odour, bitter aromatic pungent taste, pale greenish-yellow (green due to dissolved chlorophyll) colour, and slightly acid reaction. Specific gravity, 0·870 to 0·888, boiling-point, 182 to 194° C. Consists mainly of hydrocarbons, having the formula $C_{10}H_{16}$, and contains also a solid greasy substance, *Bergaptene* or *Bergamot Camphor*, $C_{17}H_{16}O_5$. The oil is only used in perfumery. Commercial samples are generally inferior, being adulterated with oil of turpentine, or the cheaper distilled oil. True *Essence of Cedrat* is the volatile oil obtained from the rind of the fruit of *Citrus medica*, but the commercial article is fictitious. It is a combination of the odours of lemon and bergamot.

Ægle Marmelos—Bael Fruit Tree—Indian Bael—Bengal Quince.

BELÆ FRUCTUS—*Bael Fruit*—The dried half-ripe fruit of *Ægle Marmelos*, Correa.

Characters.—Fruit roundish, about the size of a large orange, with a hard, woody, nearly smooth rind ; usually imported in dried more or less twisted slices, or in fragments consisting of portions of the rind and adherent dried pulp and seeds. Rind about $\frac{1}{8}$ inch thick, hard, and covered with a nearly smooth pale brown or greyish finely adherent epicarp ; the pulp firm and brittle, and of an orange-brown or cherry-red colour externally, but when broken it is seen to be nearly colourless internally. It has no odour, and its taste is simply mucilaginous, and very slightly acid.

Active Principles.—Bael fruit is said to contain *tannin*, a *concrete volatile oil*, a bitter principle, and a *balsamic principle*. The presence of *tannin* or any astringent principle is denied by Flückiger, who found that it yields a considerable quantity of *mucilage*, partly soluble and partly swelling up like tragacanth in water. This *mucilage* appears to be the real medicinal constituent.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Extractum liquidum.	Dried fruit.	1 in 1.	1 to 2 drachms.

EXTRACTUM BELÆ LIQUIDUM—LIQUID EXTRACT OF BAEL. —*Take of Bael fruit*, 1 *pound; distilled water*, 12 *pints; rectified spirit*, 3 *fluid ounces. Macerate the bael for twelve hours in* $\frac{1}{3}$ *of the water, pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining* $\frac{2}{3}$ *of water; press the marc, and filter the mixed liquors through flannel. Evaporate to* 13 *fluid ounces, and, when cold, add the rectified spirit.*

This process is known as triple maceration. The rectified spirit is added as a preservative.

Therapeutics.—Bael is highly esteemed in India, where all parts of the tree are used medicinally, and are said to operate as a febrifuge, tonic, diaphoretic, and astringent. The fruit is employed as an astringent in diarrhœa and dysentery, chronic irritation of the bowels, &c. It is suitable for weakly people and children, as it gives tone to the alimentary canal, without producing constipation. The astringency is confined to the unripe fruit, the ripe fruit being aperient rather than astringent.

Adulterations or Substitutions.—The rind of *Mangosteen*, the fruit of *Garcinia Mangostoma*, has been substituted for bael. It is in irregular fragments, *without* any adherent pulp. *Wood Apple*, the fruit of *Feronia Elephantum*, is sometimes supplied for bael. It resembles bael externally, but is *one-celled*, bael being 10 to 15 celled. *Pomegranate Peel* has been offered as Indian Bael. It is strongly astringent, and gives a blue-black precipitate with ferric chloride.

Nat. Ord. **SIMARUBACEÆ**—The Quassia or Simaruba Order.—Shrubs or trees, inhabiting principally the tropical parts of India, America, and Africa. The plants are generally characterised by a bitter principle, and are employed as tonics and febrifuges.

Official Plant.

Botanical Name.	Part Used.	Habitat.
PICRÆNA EXCELSA.	Wood.	Jamaica.

Picræna excelsa—Jamaica Quassia—Bitter Wood—Bitter Ash.

QUASSIÆ LIGNUM—*Quassia Wood.*—The chips, shavings, or raspings of the wood of *Picræna excelsa*, Lindl.

Characters and Test.—In billets and logs, varying in length and size, but frequently as thick as a man's thigh, and covered by a dark-grey bark. The wood is dense, tough, porous, and of a pale yellowish-white colour. In the pharmacies it is commonly met with in the form of chips, shavings, or raspings of the wood only, which are inodorous,[1] but have an intense and purely bitter taste. An infusion does not become black or bluish-black on the addition of a persalt of iron.[2]

[1] Some samples of quassia chips have a musty odour from having been moistened with water or "welled." An infusion made from such quassia soon spoils. [2] Other woods are darkened by persalts of iron, owing to the presence of *tannin*. Sometimes quassia wood shows dark markings or patches, due to the *mycelium* of a fungus.

Active Principles.—The bitterness of quassia has been attributed to *quassiin*, $C_{10}H_{12}O_3$ (?), a neutral, intensely bitter, crystalline substance, of which it is said to yield 0·1 per cent. Recently three substances have been separated, viz.: (1) a bitter principle in acicular crystals, having the formula $C_{35}H_{46}O_{10}$; (2) a bitter principle in prismatic crystals, having the formula $C_{36}H_{48}O_{10}$; (3) a minute quantity of a less bitter fluorescent principle, giving alkaloidal reactions. It contains also a yellow *resin*, but no *tannin*.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Wood.	...	3 to 5 grains.
Infusum.	"	1 in 80.	1 to 2 ounces.
Tinctura.	"	1 in 27.	½ to 2 drachms.

EXTRACTUM QUASSIÆ — EXTRACT OF QUASSIA.—*Take of Quassia wood, rasped,* 1 *pound; distilled water, a sufficiency. Macerate the Quassia with eight fluid ounces of the water for twelve hours; then pack in a percolator, and adding more of the water, allow the liquid* *slowly to pass until the Quassia is exhausted. Evaporate the liquor, filter it before it becomes too thick, and again evaporate by a water-bath, until the extract is of a suitable consistence for forming pills.*

An aqueous extract made by maceration and percolation. Forty-eight pounds of wood yield about one pound of extract.

INFUSUM QUASSIÆ—INFUSION OF QUASSIA.—*Take of Quassia wood, in chips,* 55 *grains; cold distilled water,* 10 *fluid ounces. Macerate in a covered vessel for half an hour, and strain.*

This infusion speedily spoils. The addition of a minute proportion of chloroform preserves it for a considerable time. Like infusion of calumba, it is prepared with cold water, which freely dissolves the bitter principle, so that heat would be a disadvantage.

TINCTURA QUASSIÆ—TINCTURA OF QUASSIA.—*Take of Quassia wood, in chips,* ¾ *ounce; proof spirit,* 1 *pint.*

Made by the same process as tincture of orange.

Therapeutics.—Quassia acts only as a pure bitter tonic and stomachic on man, devoid of aroma or astringency; also as an anthelmintic in thread-worm. It is given in atonic dyspepsia, in convalescence from acute diseases, and from delirium tremens, and it has been also employed as a febrifuge in intermittent fever. As an anthelmintic it is best given as an enema. It is commonly used, in combination with alkalies, in the dyspepsia which follows free living, and is valuable as a vehicle for chalybeate medicines, with which, as it contains no tannin, it is compatible. Compared with the other simple bitters, quassia is more powerful, large doses acting as an irritant and causing vomiting, and hence is not so well borne in the milder cases of dyspepsia; it also differs in being poisonous to some of the lower forms of animal life, and probably in virtue of this action checks fermentation in dyspeptic derangements. It is sometimes administered by using a cup made of the wood; this, when filled with water, imparts its active principles to that fluid. An infusion, sweetened with sugar, is used to kill flies, on which it acts as a narcotic poison.

Adulterations or Substitutions.—The wood of *Quassia amara*, Linn., Surinam Quassia, resembles the official or Jamaica Quassia closely both in appearance and properties, and it seems to have been the original quassia of commerce. It is readily distinguished by the stems being only 4 inches or less in diameter. Other woods are sometimes mixed with quassia. They are detected by the absence of bitterness, and by being darkened with ferric chloride. A good sample should be free of any musty odour.

Simarouba amara—Simarouba—(*not official*)—The mountain damson of Jamaica.—The root bark is met with in pieces of several feet in length, doubled upon themselves, and either flat or quilled. It contains a bitter principle analogous to that of quassia, and acts as a bitter tonic, being specially recommended in the advanced stages of diarrhœa and dysentery.

Simaba Cedron—The Cedron tree of New Granada—(*not official*). —The seeds are used in Central America as a febrifuge, and also a specific against snake-bites.

Nat. Ord. **VITACEÆ or AMPELIDEÆ**—The Vine Order.—Climbing shrubby plants, inhabiting the warm and tropical regions of the globe.

Official Plant.

Botanical Name.	Part Used.	Habitat.
Vitis vinifera.	Dried Fruit and Expressed Juice.	Spain.

UVÆ—Uvæ Passæ—*Raisins.*—The ripe fruit of *Vitis vinifera*, Linn. Dried by the heat of the sun, or partly by the sun's heat, and partly by artificial heat. Imported from Spain.

Characters.—More or less shrivelled and compressed; smooth, and free from sugary or saline incrustation; agreeably fragrant; pulp soft; very sweet.

VINUM XERICUM—*Sherry*—A Spanish Wine. Made by fermenting the unmodified juice of white grapes.

Characters.—Pale yellowish brown, containing about 17 per cent. of alcohol.

Therapeutics.—The most esteemed kind of raisin is the Muscatel; Malaga, Sultana, and Smyrna raisins are also largely used. Corinthian raisins, commonly called *currants*, are the produce of a small grape which abounds in the Ionian Islands. The chief constituents of raisins are *grape sugar*, *acid tartrate of potassium*, *malic* and *racemic acids*, and *mucilage*. The seeds contain 15 to 18 per cent. of a bland *fixed oil*, and 5 to 6 per cent. of *tannin*. Raisins are used as flavouring adjuncts to other medicines, such as the compound tincture of cardamoms and tincture of senna. Grapes are given to the sick and convalescent for the sake of their cooling and refreshing properties. Grapes have also been given in large quantities in what is termed on the Continent the "grape cure" of certain chronic maladies.

Sherry is employed in the preparation of all the official wines except three. The exceptions are—Vinum Aurantii, Vinum Ferri Citratis, and Vinum Quininæ.

Nat. Ord. **SAPINDACEÆ**—The Soapwort Order—(*not official*).—Trees, shrubs, or climbing herbaceous plants. Chiefly tropical, found also in the temperate zone. The order contains many plants yielding edible fruits, and others which are poisonous. A saponaceous principle exists in certain species.

Paullinia sorbilis—Guarana—(*not official*).—*Habitat*, Brazil.

GUARANA—*Guarana or Brazilian Cocoa.*—The seeds of *Paullinia sorbilis*, Martius, roasted, ground, made into a stiff paste with water, rolled into cylinders and dried.

Characters.—In irregularly cylindrical rolls, from 5 to 8 inches long, and weighing about 1 pound, or in powder; colour dark reddish-brown; taste astringent, bitter; odour resembling chocolate. It contains from 4 to 5 per cent. of *guaranine*, an alkaloid identical with *caffeine;* also *saponin*, *tannin*, an acrid, green *fixed oil*, and *volatile oil.*

ELIXIR GUARANÆ (B.P.C.)—ELIXIR OF GUARANA—(*not official*).—*Take of Guarana, in No.* 60 *powder,* 4 *ounces; light magnesia,* ½ *ounce; oil of cinnamon,* 6 *minims; syrup,* 2 *fluid ounces; proof spirit, a sufficiency. Mix the powders intimately, and moisten them with* 3 *ounces of proof spirit. After twenty-four hours' maceration, mix with* 8 *ounces of coarse sand, and pack in a percolator; pass through proof spirit until* 16 *ounces are obtained, then transfer the mass to a press-bag and apply pressure. To the percolate add the syrup and oil of cinnamon, and make up to* 1 *pint by addition of the expressed liquid, previously reduced by evaporation if necessary.*

Dose.—½ to 2 drachms.

Therapeutics.—Guarana contains about twice as much *caffeine* as tea and five times as much as coffee. It acts as a nervine tonic, and has been particularly recommended for migraine or nervous sick-headache. For this purpose a dose of from 30 to 60 grains of the powder is said to be a certain remedy. It may be given infused in a cup of boiling water, and sweetened. It is useful also in diarrhœa and dysentery. Its occasional irritant action has been attributed to the *saponin* which it contains.

SUB-CLASS II.—CALYCIFLORÆ.

Nat. Ord. **CELASTRACEÆ**—The Spindle Tree Order—(*not official*).—Small trees or shrubs inhabiting the warm parts of Europe, North America, and Asia; found also at the Cape of Good Hope.

Euonymus atropurpureus, *Jacquin*—Wahoo—Spindle Tree—Burning Bush—(*not official*)—*Habitat*, United States.—Wahoo bark occurs in quilled or curved pieces, $\frac{1}{12}$ inch thick; ash-grey externally, whitish within; odour faint, peculiar; taste sweetish, slightly bitter and acrid. Its properties are attributed to a neutral, non-crystalline, intensely bitter substance, soluble in alcohol and water, which has been named *Euonymin.* The bark contains three *resins* and a *volatile oil.*

TINCTURA EUONYMI—TINCTURE OF EUONYMUS (*B.P.C.*)—(*not official*).—*Take of Euonymus, in No.* 20 *powder,* 4 *ounces; rectified spirit,* 1 *pint.* Made by the same process as tincture of Aconite.

Dose.—10 to 40 minims.

EUONYMIN.—This, which must not be confounded with the active principle referred to above under the same name, belongs to the same class of eclectic resinoids as *Podophyllin.* Unlike the latter, however, it is not prepared by precipitation, but consists of an aqueous or alcoholic extract of the root or stem bark dried by the addition of phosphate of calcium, magnesia, sugar of milk, or lycopodium. There are two commercial varieties known as *Green Euonymin* and *Brown Euonymin.* The former contains chlorophyll, and is very frequently adulterated, the added material constituting from 30 to 60 per cent. of the sample. Baryta has been found in some samples. The latter variety is to be preferred as being less frequently contaminated. About 85 per cent. of the sample should be soluble in proof spirit, and the total ash should not exceed 15 per cent.

Dose.—1 to 3 grains.

Therapeutics.—The bark possesses tonic, hydragogue, cathartic, diuretic, and antiperiodic properties. The resinoid *Euonymin* acts as a powerful hepatic stimulant; but it is only a feeble intestinal stimulant. It is best administered at bedtime in the form of a pill, made with extract of henbane, and followed by a saline aperient in the morning.

Nat. Ord. **RHAMNACEÆ**—The Buckthorn Order.—Shrubs or trees, generally distributed. The plants generally possess acrid and purgative properties.

Official Plants.

Botanical Name.	Part Used.	Habitat.
RHAMNUS FRANGULA. " PURSHIANUS.	Dried bark. " "	Indigenous. California.

Rhamnus Frangula—Black Alder—Alder Buckthorn.—Berry-bearing Alder.

Botany.—A slender, somewhat straggling bush, 6 to 12 feet high, *spineless. Leaves,* alternate, long stalked, with small deciduous stipules, entire, obovate-oval, acuminate. *Flowers,* in small axillary clusters, greenish-white, small. *Ovary,* 3-lobed, 3-celled, with a short simple style, and faintly 3-lobed stigma. *Fruit,* a purplish-black, 2-seeded berry. In hedges and thickets on damp clay soils; rare in Scotland. Flowers in early summer.

RHAMNI FRANGULÆ CORTEX—*Frangula Bark.*—The dried bark of *Rhamnus Frangula,* Linn. Collected from the young trunk and moderate-sized branches, and kept at least one year before being used.[1]

Characters.—In small quills,[2] the bark itself being about $\frac{1}{25}$ inch or somewhat more in thickness, and covered with a greyish-brown or blackish-brown corky layer, with transverse whitish lenticels; inner surface smooth, brownish-yellow; fracture short, and purplish externally, but somewhat fibrous and yellowish within. No marked odour; taste pleasant, sweetish, and slightly bitter.

[1] Baildon,-who recommended this bark for medicinal use, kept it for several years before using. [2] Older bark yields a nauseous liquid extract.

Active Principles.—It is always difficult to determine the active principle of plants possessing purgative properties, and this is true of *Rhamnus Frangula.* The bark, after keeping one year, contains 0·06 per cent. of the glucoside *Frangulin,* $C_{21}H_{20}O_9$, and 0·10 per cent. of *Emodin,* $C_{15}H_{10}O_5$, identical with the *Emodin* of rhubarb. When boiled with dilute sulphuric acid, *Frangulin* splits up into glucose and *Emodin,* thus:—

$$\underset{\text{Frangulin.}}{C_{21}H_{20}O_9} + H_2O = \underset{\text{Emodin.}}{C_{15}H_{10}O_5} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

The fresh bark yields no *Frangulin,* and only traces of *Emodin.* Hence the importance of storing the bark for one year before use. Preparations of the fresh bark also cause griping, an effect attributed to a *ferment* in the fresh bark, which is believed to have exhausted itself before the bark is used.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Dried bark.	...	15 to 60 grains.
„ Liquidum.	„ „	1 in 1.	1 to 2 drachms.

EXTRACTUM RHAMNI FRANGULÆ—EXTRACT OF RHAMNUS FRANGULA.—*Take of Rhamnus Frangula bark, in No. 40 powder, 1 pound; proof spirit, 2 pints; distilled water, a sufficiency. Macerate the rhamnus bark with the proof spirit in a closed vessel for 48 hours; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with water until 3 pints of liquor have been collected, or the bark is exhausted. Evaporate the percolated liquor by a water-bath to a suitable consistence.*

A diluted alcohol extract prepared by maceration and percolation.

EXTRACTUM RHAMNI FRANGULÆ LIQUIDUM.—LIQUID EXTRACT OF RHAMNUS FRANGULA.—*Take of Rhamnus Frangula bark, in coarse powder, 1 pound; rectified spirit, 4 fluid ounces; distilled water, a sufficiency. Boil the bark in three or four successive quantities of the water until exhausted. Evaporate the liquors by the heat of a water-bath to 12 fluid ounces; when cold add the spirit, allow to stand for some hours, then filter, and make up to 16 fluid ounces with distilled water.*

An aqueous extract prepared by repeated decoction. The spirit acts as a preservative, and precipitates albuminoid and mucilaginous matters, which are removed by filtration.

Therapeutics.—Introduced by Baildon of Edinburgh as an agreeable laxative or purgative, free from irritating properties, and suitable for delicate constitutions and the aged. Therapeutically it closely resembles *Rhamnus Purshianus*, which is now much more generally employed.

Rhamnus Purshianus—R. Purshiana.—The Cascara Sagrada, Sacred Bark, or Chittern Bark Tree.

RHAMNI PURSHIANI CORTEX — *Rhamnus Purshianus Bark—Sacred Bark—Cascara Sagrada.*—The dried bark of *Rhamnus Purshianus*, D.C. Should be kept after collection for one or two years before being used.

Characters.—In quills or incurved pieces of varying lengths and sizes, the bark itself $\frac{1}{25}$ to $\frac{1}{8}$ inch thick, smooth or nearly so externally, covered with a greyish-white layer, which is usually easily removed, and frequently marked with spots or patches of adherent lichens. Beneath the surface it is violet-brown, reddish-brown, or brownish; and internally, reddish or yellowish-brown, and nearly smooth, although somewhat striated longitudinally. Fracture short, except internally, where it is slightly fibrous, more especially in the larger pieces. Taste bitter.[1] It is frequently imported in flattened packets, consisting of small pieces of the bark compressed into a more or less compact mass.[2]

[1] It has a faint characteristic odour, reminding one of a cow byre.

[2] This latter description applies to the best bark as now met with in commerce, except that the thin flat pieces are not put up in packets.

Active Principles.—There are conflicting statements as to these. Schwabe found *Emodin*, $C_{15}H_{10}O_5$, but no *Frangulin*. Zieg found (1) 5·4 per cent. of an inert, red *resin*, soluble in alcohol, insoluble in ether. (2) 1·08 per cent. of an inert yellowish-brown *resin*, soluble in ether, insoluble in alcohol. (3) A dark-brown, slightly bitter *resin*, soluble in alcohol and ether, giving an intense purple with potassium hydrate, and acting as a marked laxative in doses of 5 grains. (4) A *glucoside* which, when acted upon by dilute acids, decomposes with production of an intensely *bitter principle*, to which the tonic properties of the bark are attributed. Meier and Webber found also a *lactic ferment*, *glucose*, and *ammonia*. The *glucose* renders the solid extract unstable, and the *ammonia* appears to hold the active resinous constituent in solution in the fluid extract. The odour of the bark is due to a *volatile oil*.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Dried bark.	...	2 to 8 grains.
,, Liquidum.	,,	...	½ to 2 drachms.

EXTRACTUM CASCARÆ SAGRADÆ—EXTRACTUM RHAMNI PURSHIANI—EXTRACT OF CASCARA SAGRADA.—*Cascara Sagrada, in No. 40 powder, 1 pound; proof spirit, 2 pints; distilled water, a sufficiency.*

Made by the same process as extract of *Rhamnus Frangula*. The bark yields about 40 per cent. of extract.

EXTRACTUM CASCARÆ SAGRADÆ LIQUIDUM.—EXTRACTUM RHAMNI PURSHIANI LIQUIDUM—LIQUID EXTRACT OF CASCARA SAGRADA.—*Take of Cascara Sagrada, in coarse powder, 1 pound; rectified spirit, 4 fluid ounces; distilled water, a sufficiency.*

Made by the same process as liquid extract of *Rhamnus Frangula*. An excellent liquid extract can be prepared by percolation with water. The official liquid extract has a disagreeable bitter taste. A tasteless liquid extract is prepared by macerating 1 pound of Cascara Sagrada in No. 40 powder, with 1 ounce of calcined magnesia in 30 fluid ounces of distilled water for 12 hours. This is dried, moistened with 18 fluid ounces of proof spirit, packed in six percolators and exhausted by repercolation, the first 14 ounces of percolate being reserved. The remainder is evaporated to a syrup, added to the reserved portion, and the measure made up to 16 fluid ounces with proof spirit. The ordinary fluid extract may be rendered tasteless by the addition of a small proportion of liquor potassæ. It is alleged that the process for removing the bitterness destroys the activity of the drug. The evidence on this point is conflicting. The fluid extract seems to deteriorate by exposure to the air.

ELIXIR CASCARA SAGRADA (*B.P.C.*)—ELIXIR OF CASCARA SAGRADA (*not official*).—*Take of tincture of fresh orange-peel*, 2 *fluid ounces; rectified spirit*, 1 *fluid ounce; cinnamon water*, 3 *fluid ounces; syrup*, 6 *fluid ounces; liquid extract of Cascara Sagrada*, 8 *fluid ounces. Mix.*

Dose.—15 minims to 2 drachms.

SYRUPUS CASCARA SAGRADA (*B.P.C.*)—SYRUP OF CASCARA SAGRADA.—*Take of liquid extract of Cascara Sagrada*, 4 *fluid ounces; liquid extract of liquorice*, 3 *fluid ounces; carminative tincture* (*B.P.C.*), 2 *fluid drachms; syrup, sufficient to produce* 1 *pint. Mix.*

Dose.—1 to 4 fluid drachms.

Therapeutics.—Cascara Sagrada has come into very extensive use as an excellent laxative in cases of obstinate and habitual constipation. It closely resembles *Rhamnus Frangula*, but is said to be more powerful and certain in its action. It possesses the great advantage that its continued use so influences the intestinal canal that the glandular and peristaltic actions become of themselves sufficiently active. The best results are sometimes obtained by a single dose of 30 minims at bedtime, but in other cases it is better to give 20-minim doses thrice daily after meals. It is especially useful when a mild non-irritant laxative is required, as during pregnancy, and for internal piles. The fluid extract is very conveniently administered in the form of capsules of gelatine containing 15 to 30 minims or more.

Adulterations or Substitutions.—A variety known as *Oregon Cascara* has been met with in bold handsome quills; externally marked by foliaceous and other lichens, and somtimes mossy; internally pale dull cinnamon-brown; and less bitter and more mucilaginous than the official *Californian Cascara.* It possesses the same properties, and appears to be the same species collected in a different locality. A "*spurious*" *Cascara* has been met with in irregular incurved pieces or quills; dark dull earthy brown externally, and with here and there thin strips of silvery white wood adhering to the inner surface, as if the bark had been cut or very forcibly torn from the tree. It has the odour of Cascara, and a sweetish taste almost devoid of bitterness. It consists of true Cascara bark collected "out of season."

Rhamnus catharticus—Buckthorn—(*not official*).—The recently expressed juice of the ripe berries was official in the Pharmacopœia of 1867. The juice contains active principles similar to those of the species of *Rhamnus*. It is a powerful hydragogue cathartic, but its action is frequently attended with severe griping, nausea, and thirst. The *Syrupus rhamni* of the 1867 Pharmacopœia has therefore been omitted in the new edition, but it is still used in veterinary medicine as a purgative for dogs in combination with syrup of poppies and castor-oil. The pigment, *sap-green*, the French *vert de vessie*, is prepared by evaporating to dryness fresh buckthorn juice which has been previously mixed with lime. *R. catharticus* is distinguished from *R. Frangula* by the smaller *branches* terminating in a *spine*, the *flowers* being diœcious, the *style* 4-cleft, and the *berries* 4-seeded instead of 2-seeded.

Nat. Ord. **AMYRIDACEÆ** or **BURSERACEÆ**—The Myrrh and Frankincense Order.—Trees or shrubs, natives of tropical India, Africa, and America. The plants abound in fragrant balsamic resin; some are poisonous, others bitter, purgative, and anthelmintic.

Official Plants.

Botanical Name.	Part Used.	Habitat.
BALSAMODENDRON MYRRHA.	Gum Resin.	Somali Country, East Africa.
CANARIUM COMMUNE.	Resin.	Manila.

Balsamodendron Myrrha—The Myrrh Tree.

MYRRHA—*Myrrh.*—A gum-resinous exudation from the stem of *Balsamodendron Myrrha*, Nees.

Characters.—In roundish or irregular formed tiers or masses of agglutinated tiers, varying very much in size; reddish-brown or reddish-yellow externally, dry, and more or less covered by a fine powder; brittle, fractured surface irregular, somewhat translucent, rich brown, oily, and frequently marked with opaque whitish spaces or striæ. Odour agreeable, aromatic; taste aromatic, bitter, and acrid.

Myrrh as it exudes naturally from the tree is of a soft oily nature and yellowish-white colour. It soon assumes a golden colour, and ultimately hardens and becomes reddish. It is collected mainly by the Somali tribe of Africans, and shipped to Bombay, whence it is imported to Europe. The packages, which contain various qualities of myrrh (along with *opaque Bdellium* from *Balsamodendron Play-*

fairii), are opened in Bombay, the Bdellium removed, and the myrrh sorted into pale, *picked Myrrh* or *Turkey Myrrh*, a darker *inferior Myrrh* and *refuse Myrrh*. The two former go to Europe, and the latter to China.

Active Principles.—Myrrh contains 40 to 50 per cent. of gum (15 per cent. of it insoluble in water), 23 to 44 per cent. of bitter *resin* called *Myrrhin*, $C_{48}H_{32}O_{10}$, neutral, but readily becoming acid when fused, and from 0·75 to 3 per cent. (Schimmel, 2·5 to 6·5 per cent.) of aromatic *volatile oil*, *Myrrhol*, $C_{10}H_{14}O$. The *resin* and *oil* are entirely soluble in alcohol.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Tinctura.	Gum resin.	1 in 8.	½ to 1 drachm.
Pilula Aloes et Myrrhæ.	" "	1 in 6.	5 to 10 grains.

Contained also in *Decoctum Aloes Co.*, *Mistura Ferri Co.*, *Pil. Asafœtidæ Co.*, and *Pil. Rhei Co.*

TINCTURA MYRRHÆ—Tincture of Myrrh.—*Take of myrrh, in coarse powder*, 2½ *ounces; rectified spirit*, 1 *pint*.

Made by the same process as tincture of aconite. It contains only the *resin* and *volatile*. The residual *gum* makes a good adhesive mucilage with water, which keeps well.

PILULA ALOES ET MYRRHÆ.—*See* Aloes.

Therapeutics.—Myrrh, in small doses, acts as a stimulant and tonic, giving an impetus to the digestive organs, and an increase of muscular power to the intestinal canal; it causes, also, a diminution of the exhalations from mucous membranes, and hence gives rise to slight constipation. In large doses its stimulating effects are more fully developed, and there is a tendency to acridity. Topically, myrrh acts mildly as an astringent. It is rarely given alone internally, but in combination with other appropriate remedies. Its use is indicated where there is debility of the system and general relaxation of the tissues, and it is contra-indicated in inflammatory cases and in plethoric habits. It is useful in cases of chronic discharges from any of the mucous membranes. It has no true emmenagogue properties, as has been erroneously stated. The dose is from 10 to 30 grains in powder or pill, or suspended in water, as in the famous antihectic mixture of Dr Griffith, *Mistura Ferri Composita*. Topically, it is useful as a wash for the gums and throat, and as an application to foul ulcers.

Adulterations.—Myrrh frequently contains various other gums, resins, &c. *Arabian Myrrh* differs from the official in being destitute of the whitish opaque markings of the latter. *East Indian Myrrh* or *Bissa Bol* closely resembles the official, but is usually darker, has a peculiar lemon-like odour, and a taste like spring mushroom. *Indian Bdellium* softens in the hand, and has an acrid taste and a faint cedar-like aroma. The surface frequently has hairs or pieces of papery bark attached to it. *Opaque Bdellium* is in opaque pieces, with a bitter taste, free of acridity. All the foregoing gum-resins are the produce of various species of *Balsamodendron.* Myrrh also frequently contains gums, such as *acacia gum* and *cherry-tree gum*, which are not acted upon by alcohol, have no odour of myrrh, and a clear dry fracture. Dark-coloured pieces, the alcoholic solution of which is not rendered purple by nitric acid, and pieces of gum which dissolve completely, as well as those which merely swell up in water, should be rejected.

Canarium commune—Manila Elemi Tree—Java Almond.

ELEMI.—*Manila Elemi.*—A concrete resinous exudation, the botanical source of which is undetermined, but is sometimes referred to *Canarium commune*, Linn.

Characters.—When fresh, soft, granular, resinous, and colourless, by keeping becomes harder, and of a pale yellow tint. Odour strong and fragrant, somewhat resembling fennel and lemon. Moistened with rectified spirit, it breaks up into small particles, which, when examined by the microscope, are seen partly to consist of acicular crystals (Amyrin).

Active Principles.—Elemi is really a concrete oleo-resin, and contains from 10 to 17 per cent. of *volatile oil*, $C_{10}H_{16}$, to which the characteristic odour is due. It also contains about 60 per cent. of an acid and a neutral *amorphous resin*, soluble in cold alcohol; 20 to 25 per cent. of *Amyrin*, $C_{25}H_{42}O$, a neutral crystalline substance, soluble in hot alcohol; and small quantities of a neutral bitter crystalline body, *Bryoidin*, $C_{20}H_{38}O_3$, soluble in boiling water, and an acid body, *Elemic Acid*, $C_{35}H_{56}O_4$, in large brilliant crystals.

Official Preparations.

Name.	Part Used.	Strength.
Unguentum Elemi.	Oleo-resin.	1 in 5.

UNGUENTUM ELEMI—Ointment of Elemi.—*Take of Elemi, ¼ ounce; simple ointment, 1 ounce. Melt, strain through flannel, and stir constantly until the ointment solidifies.*

Therapeutics.—Elemi is a stimulant, and acts like the turpentines, but is never employed internally. The ointment is used as a stimulant application to chronic indolent sores, and also to promote the discharge caused by setons and issues.

Adulterations.—Manila Elemi is sometimes adulterated with *colophony* and *turpentine;* detected by the strongly terebinthinate odour of the sample. Elemi itself has only a very faint terebinthinate odour, and resembles rather a mixture of lemon and fennel. It is sometimes contaminated by carbonaceous matter, rendering it grey or blackish, and sometimes contains also chips and other impurities. It should be wholly soluble in ether. Other varieties of Elemi are Brazilian Elemi from *Icica Icicariba*, and Mexican Elemi from *Amyris elemifera*. They resemble the official Elemi, but are now rarely met with.

Boswellia Carterii.—The Frankincense or Luban Tree (*not official*).—*Habitat*, Arabia and Eastern Tropical Africa.

The *gum-resin* Olibanum, the Frankincense of the ancients, is obtained from the above and other species of *Boswellia*. It occurs in roundish, pear-shaped, or somewhat stalactite tears, or in agglutinated pieces, dry, and covered with a whitish dust; colour greenish, pale yellowish, or brownish; brittle; fracture dull and waxy; taste slightly bitter, terebinthinate; odour pleasantly aromatic, more marked when heated. Olibanum contains 4 to 7 per cent. of *volatile oil*, 27 to 35 per cent. of *gum*, and 56 to 72 per cent. of *resin*. It is reputed to be stimulant, diaphoretic, and diuretic. Locally applied, it acts like Elemi.

Nat. Ord. **ANACARDIACEÆ**—The Cashew or Sumach Order. —Trees or shrubs, chiefly inhabiting tropical America, Africa, and India. The plants abound in a milky, resinous, or somewhat gummy, acrid, and poisonous juice, which sometimes becomes black on drying.

Official Plant.

Botanical Name.	Part Used.	Habitat.
Pistacia Lentiscus.	Resin.	Scio.

Pistacia Lentiscus—Lentisk—Mastic Tree.

MASTICHE—*Mastich.*—A concrete resinous exudation obtained by making incisions in the bark of the stem and large branches of *Pistacia Lentiscus*, Linn.

Characters.—In rounded, irregular, oblong or pear-shaped tears, of a pale yellow colour, and either opaque and dusty on their outer surface, or more frequently having a glassy and transparent appearance; brittle, and breaking with a vitreous, conchoidal, pale yellow fracture. Odour agreeable, somewhat balsamic and terebinthinous; taste mild and resinous. Becoming plastic when chewed; entirely soluble in ether.

In the month of June vertical incisions are made in the bark of the stem and large branches, from which the resin flows and soon dries. It is collected with great care in from fifteen to twenty days afterwards. A good tree yields from 8 to 18 pounds of mastich. A very fine quality of the resin exudes spontaneously. An inferior quality consists of resin which has been allowed to drop on to the ground.

Active Principles.—Mastiche consists of 90 per cent. of an acid resin, *Masticic Acid*, $C_{20}H_{31}O_2$, soluble in alcohol; 10 per cent. of a neutral resin, *Masticin*, $C_{20}H_{32}O_3$, insoluble in alcohol; and a little *volatile oil*, $C_{10}H_{16}$ (2 per cent. Schimmel).

Therapeutics.—There are no official preparations of mastich. It possesses stimulant properties, and acts like the ordinary coniferous turpentines. It is chiefly prescribed in pills to divide active medicines, or with mercurials when they are to be silvered to prevent the silver being acted upon by the mercury. A piece of cotton saturated with a solution of 4 parts mastich in 7 parts of ether is used by dentists as a temporary stopping for carious teeth. Dissolved in alcohol or oil of turpentine it forms a brilliant varnish.

Adulterations.—Mastich is occasionally adulterated with olibanum, detected by its different colour and glassy fracture; sandarach, detected by its breaking to powder when bitten, and being in cylindrical tears; pseudo-mastich, the gummy exudation of *Atractylis gummifer*, detected by being insoluble in alcohol; and in seasons of scarcity, sea-salt, detected by being insoluble in ether.

Pistachia Terebinthus—Chian Turpentine Tree—(*not official*).—*Habitat*, Scio.

TEREBINTHINA CHIA—*Chian, Scio, or Cyprus Turpentine.*—A liquid oleo-resinous exudation obtained by incision from the stem of *Pistacia Terebinthus*, Linn.

Characters.—Genuine Chian turpentine is of a tenacious, honey-like consistence, slightly brittle, and becoming more so with age and exposure to the air; colour yellow, brownish-yellow, or greenish-brown; odour resembling citron and jasmine, more agreeable and aromatic than the coniferous turpentines; taste agreeable, like mastiche, free from the bitterness and acridity of coniferous turpentines. It is soluble in alcohol, forming a slightly fluorescent solution which reddens litmus, and leaving from 2 to 7 per cent. of impurities, chiefly sand.

Dose.—5 to 10 grains.

Active Principles.—It contains from 9 to 14·5 per cent. of volatile oil, $C_{10}H_{16}$. The remainder consists of about 80 per cent. of an acid resin identical with the *Mastichic Acid* of mastich, and about 4 to 6 per cent. of a second *acid* resin and a trace of *benzoic acid.* It contains no *Masticin.*

Therapeutics.—Chian turpentine has the stimulant and diuretic properties of the coniferous turpentines, but had become obsolete till 1880, when it was strongly recommended as a remedy in cancer, more especially of the female generative organs. It has been pretty largely employed, but the evidence as to its value is conflicting. It may be conveniently administered in the form of an emulsion, Misturæ Terebinthinæ Chiæ, acacia gum, 480 grains; tragacanth, 100 grains; Chian turpentine, 480 grains dissolved in ether, 1 ounce; distilled water to make 16 ounces. Add the ethereal solution to the mixed gums in a mortar, add boldly 2 ounces of water and triturate till emulsified, and add gradually 11 ounces of water, stirring frequently till the ether evaporates. Transfer to a bottle, and make up to 16 fluid ounces with water.

Dose.—1 drachm, increasing to 3 drachms, thrice daily after food. It may also be given in the form of a pill containing 3 grains Chian turpentine and 2 grains sublimed sulphur. Dose, 2 every four hours.

Adulteration.—From its scarcity and high price, Chian turpentine is frequently adulterated with coniferous turpentines, such as a mixture of Canada balsam and colophony; or they are wholly substituted for it. They can be detected by their less agreeable terebinthinate odour and their bitter acrid taste.

Pistacio vera—The Pistacio Nut Tree—(*not official*).—Furnishes the Pistacio nuts of commerce, which are used as an article of food in the East, and yield a bland fixed oil, sometimes used for toilet and dietetic purposes.

Rhus Toxicodendron—Sumach or Poison-Oak. **Rhus radicans**—Poison-Vine. **Rhus venenata**—Poison-Elder—(*not official*)—*Habitat,* North America. These plants possess similar properties, and cause itching, redness, erysipelatous œdema, and vesication of parts of the body exposed to their action. Internally, they are diaphoretic, diuretic, and slightly laxative. They have been used medicinally, chiefly for the purpose of arousing nervous energy in old-standing paralysis, in amaurosis, in some obstinate cutaneous diseases, and by the homœopaths in chronic rheumatism. The dose is 1½ to 1 grain of powdered leaves. A tincture of the fresh leaves (1 of dry leaves in 10) occurs in the British Homœopathic Pharmacopœia.

Nat. Ord. **LEGUMINOSÆ.**—The Pea and Bean Order.—Herbs, shrubs, or trees, extensively distributed, having representatives in almost every part of the world, but they are most abundant in warm regions, and gradually diminish on approaching the poles. The order has been divided into three sub-orders—*Papilionaceæ*, *Cæsalpinieæ*, and *Mimoseæ*. The properties and uses of the plants of this order are very variable.

Official Plants.

	Botanical Name.	Part Used.	Habitat.
Papilionaceæ.	ANDIRA ARAROBA.	Medullary matter.	Bahia (Brazil).
	ASTRAGALUS GUMMIFER, &c.	Gum.	Asia Minor.
	CYTISUS SCOPARIUS.	Tops (fresh and dried).	Indigenous.
	GLYCYRRHIZA GLABRA.	Root.	"
	INDIGOFERA TINCTORIA.	Colour.	India.
	MYROXYLON PEREIRÆ.	Balsam.	San Salvador.
	" TOLUIFERA.	"	New Granada.
	PHYSOSTIGMA VENENOSUM.	Seed.	West Africa.
	PTEROCARPUS MARSUPIUM.	Dried juice.	Malabar.
	" SANTALINUS.	Wood.	Ceylon.
Cæsalpineæ.	CASSIA ACUTIFOLIA.	Leaflets.	Soudan.
	" ANGUSTIFOLIA.	"	India.
	" FISTULA.	Fruit.	West Indies.
	COPAIFERA LANGSDORFII.	Oleo-resin.	Amazon River.
	HÆMATOXYLON CAMPECHIANUM.	Wood.	Jamaica.
	TAMARINDUS INDICA.	Fruit pulp.	West Indies.
Mimoseæ.	ACACIA SENEGAL, &c.	Gum.	Kordofan, E. Africa.

Andira araroba — Angelim amargoso — The Araroba or Goa Powder Tree.

CHRYSAROBINUM — *Chrysarobin* — *Araroba Powder* (?) — *Goa Powder* (?). — The medullary matter of the stem and branches of *Andira araroba*, Aguiar., dried, powdered, and purified; containing more or less chrysophanic acid according to age and condition, and yielding much chrysophanic acid by oxidation.

Characters and Tests.—As purified by solvents it is a light brownish-yellow, minutely crystalline powder, tasteless and inodorous. Very sparingly soluble in water, but almost entirely soluble in 150 parts of hot rectified spirit.[1] On heating it melts and partially sublimes in yellow vapours, leaving a charred residue, which entirely disappears on ignition in air.[2] It dissolves in sulphuric acid to form a yellow to orange-red solution, and in solution of caustic potash to form a yellow to reddish fluorescent solution which becomes carmine by absorption of oxygen from the air.[3]

[1] Indicating absence of woody tissue. [2] Indicating absence of mineral impurities. [3] The whole of the above characters and tests really apply to a mixture of proximate principles commonly but erroneously called *Chrysophanic Acid*, and which are obtained by treatment of Araroba or Goa powder with boiling benzol. In the original issue of the 1885 Pharmacopœia Chrysarobin and Goa powder were erroneously regarded as synonymous. *Goa powder* is the crude drug containing about 17 per cent. of woody tissue, while *Chrysarobin* is that portion of the crude drug soluble in boiling benzol. The geographical source of the drug is the province of Bahia in Brazil, the name Goa powder having been applied to it from its being imported to this country by way of Goa in the East Indies. Araroba or Goa powder is obtained by cutting the trunk of the tree into transverse sections, which are split longitudinally and the lumps of the drug chipped or scraped off from the clefts and hollow places in the stem in which it has been deposited. It occurs as an amorphous powder, but from being found permeating all the tissues of the stem it seems to have been originally in a fluid state. It is very crudely described as medullary matter, being apparently a degradation product formed by the destruction of cellular tissue in the same ways as gums, resins, &c. The powder occurs in largest quantity in the older trees. It is at first of a pale primrose colour, changing by exposure to the air to a darker yellow and finally purple. The official Chrysarobin is obtained by treating Goa powder with boiling benzol. On cooling, 90 per cent. of the Chrysarobin separates out as a pale yellow warty-formed crystalline

powder. The remaining 10 per cent., which is less pure, is obtained by evaporation of the benzol.

Active Principles.—The Chrysarobin of the Pharmacopœia consists almost entirely of a derivative of methyl-anthracene, having the formula $C_{30}H_{26}O_7$, to which the name *Chrysarobin* or *Chrysophan* has been applied. On exposure to air, especially in presence of an alkali, *Chrysarobin* rapidly absorbs oxygen with formation of *Chrysophanic Acid*, $C_{15}H_{10}O_4$. Dissolved in liquor potassæ, and a current of air passed through the solution, chrysophanic acid is formed thus:—

$$\underset{\text{Chrysarobin.}}{C_{30}H_{26}O_7} + 2O_2 = 3H_2O + \underset{\text{Chrysophanic Acid.}}{2C_{15}H_{10}O_4}.$$

On adding hydrochloric acid to the solution the chrysophanic acid is precipitated. Distilled with zinc dust *Chrysarobin* yields *methyl-anthracene*. *Chrysarobin* is insoluble and *Chrysophanic Acid* soluble in ammonia.

Official Preparation.

Name.	Part Used.	Strength.
Unguentum.	Chrysarobin.	1 in 25.

UNGUENTUM CHRYSAROBINI—OINTMENT OF CHRYSAROBIN.—*Take of chrysarobin,* 20 *grains; benzoated lard,* 480 *grains. Melt the lard, add the chrysarobin, and stir them together, maintaining a moderate temperature* (210° F.) *so as to promote solution; then remove the heat and stir till cold.*

20 grains chrysarobin will not entirely dissolve in 480 grains of benzoated lard. It is important that the ointment should be free of solid particles; and a fine, yellow, homogeneous ointment may be made by mixing the chrysarobin with 180 grains castor-oil and 60 grains white wax, applying heat till dissolved, adding to 240 grains benzoated lard in a mortar and stirring till cold.

Therapeutics.—The workmen who collect Araroba powder, and those who have to handle large quantities, frequently suffer severely from irritation of the eyes and face. Internally chrysarobin, in doses of $\frac{1}{6}$ to $\frac{1}{2}$ grain, is employed in eczema, impetigo, acne, psoriasis, urticaria, and other skin diseases. 8 to 20 grains act as an emetic purge, causing large discharges of bile. It is more commonly used externally in psoriasis and parasitic affections of the skin, such as ring-worm. It may be applied to the skin moistened with saliva or vinegar, or in the form of the ointment, or a solution (1 in 10) in liquor gutta percha. It has the disadvantage of staining the skin and linen. The stains may be removed by benzine, or a weak solution of potash or chlorinated lime.

Adulterations.—It has been alleged that recent supplies of chrysarobin are less active than the article found in commerce seven or eight years ago. This may be due to the presence of a larger percentage of water, which the drug seems to take up without appearing moist. Five per cent. has been stated to be the average, but Williams reports an instance of a sample yielding 38 per cent. of moisture.

Astragalus gummifer—The Tragacanth Tree.

TRAGACANTHA — *Tragacanth — Gum Dragon.*—A gummy exudation obtained by making incisions in the stem of *Astragalus gummifer*, Labill., and some other species of *Astragalus.*

Character and Tests.—In white or somewhat yellowish flaky pieces of varying length and breadth,[1] which are thin, irregularly oblong, or roundish, more or less curved, marked on the surface by arched or concentric ridges, somewhat translucent and tough,[1] but rendered more pulverisable at a temperature of 120° F. (48°·9 C.),[2] inodorous and almost tasteless. It is very sparingly soluble in cold water, but swells into a gelatinous mass, which is tinged violet or blue by tincture of iodine.[3] After maceration in cold water the fluid portion is not precipitated by the addition of rectified spirit.[4]

[1] *Smyrna tragacanth* has a yellowish tinge, distinguishing it from *Syrian tragacanth*, which is whiter, more ribbon-like, and more translucent than the former. [2] The gum contains 11 to 14 per cent. of water, which is driven off by heating, thus rendering the gum more brittle. The water is reabsorbed on exposure to the air. [3] Indicating the presence of starch grains in a slightly modified condition. [4] This is intended for the detection of gum arabic, but the statement is inaccurate, as rectified spirit produces a gelatinous precipitate. It is different, however, from the milky precipitate produced by gum arabic, and therefore the test is useful.

There are three varieties of tragacanth met with in commerce. (1) *Flaky* or *leaf tragacanth* is collected by making longitudinal incisions in the bark. The gum exudes with some force and intermittently, giving it when dry the peculiar concentrically ridged appearance. This is the only official tragacanth, and there are two varieties, one coming from Smyrna, and the other, known as *Syrian tragacanth*, coming from Kurdistan and Persia. (2) *Vermicelli tragacanth*, a second quality, exuding from punctures made in the bark, and occurring in elongated contorted vermiform pieces. (3) *Common* or *Sorts tragacanth*, a more inferior quality, which has exuded spontaneously, and occurs in pea-shaped pieces, brownish or yellowish in colour.

Active Principles.—Tragacanth is a degradation product formed by the transformation of the cells of the pith and medullary rays into a mucilaginous mass, in which the microscope reveals the remains of cellular structure, as well as starch grains. It consists of two gums, the one soluble in water, resembling the *arabin* of gum arabic, but differing from it by being precipitated by neutral acetate of lead, but not by strong solution of ferric chloride or borax; the other, *Bassorin*, *Adraganthin*, or *Tragacanthin*, $C_{12}H_{20}O_{10}$, which is insoluble, but swells up in water. The latter constitutes more than one-half of the gum.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Glycerinum.	Gum.	...	1 in 6½ nearly.
Mucilago.	„	1 in 70.	1 ounce.
Pulvis Compositus.	„	1 in 6.	10 to 60 grains.

Contained also in *confectio opii*, *confection sulphuris*, and *pulvis opii compositus.*

GLYCERINUM TRAGACANTHÆ—Glycerine of Tragacanth.—*Take of tragacanth, in powder*, 110 *grains; glycerine*, 1 *fluid ounce; distilled water*, 74 *grains. Mix the tragacanth with the glycerine in a (dry) mortar; add the water, and rub until a translucent, homogeneous jelly is produced.*

A more generally useful pill excipient may be made with tragacanth, 60 grains; glycerine, 4 fluid drachms; and distilled water, 4 fluid drachms.

MUCILAGO TRAGACANTHÆ—Mucilage of Tragacanth.—*Take of tragacanth, in powder*, 60 *grains; distilled water*, 10 *fluid ounces; rectified spirit*, 2 *fluid drachms. Mix the tragacanth with the spirit, then pour in the water, with constant agitation.*

The mixing with rectified spirit prevents caking of the gum with the water, and the mucilage is thus more expeditiously prepared. Mucilage of acacia, when required extemporaneously, may also be prepared expeditiously by previous mixing of the gum with spirit. The operation is best performed by using a mortar and pestle, although the official process contemplates the use of a dry bottle.

PULVIS TRAGACANTHÆ COMPOSITUS — COMPOUND POWDER OF TRAGACANTH.—*Take of tragacanth, in powder, gum acacia, in powder, starch, in powder, of each,* 1 *ounce; refined sugar, in powder, 3 ounces. Rub them well together.*

Therapeutics.—Tragacanth and its preparations act as emollients and demulcents. They are chiefly used as vehicles for other medicines—the glycerinum as a useful pill excipient, the mucilage to suspend insoluble substances in mixtures, and the compound powder as a vehicle for heavy active substances, such as calomel; but they may be given alone as demulcents and emollients in irritant poisoning, &c. The mucilage is used in the preparation of lozenges. Tragacanth makes a much thicker mucilage than gum arabic, but for most purposes, especially as an emulsifying agent, gum arabic is preferable.

Adulterations.—The official tragacanth in flakes is not liable to adulterations, but the powder may contain gum arabic, which is detected by the tests already mentioned. The inferior tragacanths are sometimes adulterated with (1) *Mosul* or *Moussul Gum*, supposed to be a very inferior tragacanth; (2) *Caramania Gum*, *Hog Gum Tragacanth*, or *Bassora Gum*, said to be derived from almond and plum trees. It is in nodular masses, which are broken into angular pieces to resemble tragacanth. It has a waxy lustre and a dull brown colour. To make it white it is sometimes dusted over with white lead. It is readily known by its angular appearance, and the lead may be easily detected by the ordinary reagents for that metal.

Cytisus scoparius—Sarothamnus scoparius—Spartium Scoparium—Broom.

Botany.—A shrub, 3 to 8 feet high, with angular, unarmed branches. *Leaves*, stalked and ternate at the lower, sessile and simple at the upper part; leaflets, lanceolate-obovate. *Flowers*, large, yellow, axillary, solitary, stalked, papilionaceous. *Legume*, flat, compressed, dark brown, containing about fifteen seeds. *Flowering-time*, June.

SCOPARII CACUMINA—*Broom Tops.*—The fresh and dried tops of *Cytisus scoparius*, Link. From indigenous plants.

Characters.—Branched, straight, with five wing-like angles; dark-green or yellowish-green; nearly smooth; tough. Leaves, when present, small, sessile and simple above, stalked and trifoliate below. Taste bitter and nauseous; odour when fresh and bruised, peculiar, but this is nearly lost by drying.

Active Principles.—Broom tops contain a neutral principle, *Scoparin*, $C_{21}H_{22}O_{10}$, and about 0·05 per cent. of a colourless, bitter, liquid, non-oxygenated, volatile alkaloid, *Sparteine*, $C_{15}H_{26}N_2$, which forms crystallizable, extremely bitter salts with acids.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Dried Tops.	1 in 20.	2 to 4 ounces.
Succus.	Fresh „	...	1 to 2 drachms.

DECOCTUM SCOPARII — DECOCTION OF BROOM.—*Take of broom tops, dried,* 1 *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

The addition of a little liquor ammoniæ or liquor potassæ makes the decoction clear and prevents precipitation.

SUCCUS SCOPARII—JUICE OF BROOM.—*Take of fresh broom tops,* 7 *pounds; rectified spirit, a sufficiency. Bruise the broom tops in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep in a cool place.*

This is an example of the juices of fresh medicinal plants, preserved by addition of one-third of their volume of rectified spirit, as suggested by Mr Peter Squire. The advantage claimed for them is that the properties of the plant juice are not impaired by the action of the air in drying, or by the action of heat and air, as in evaporating to form an extract. They vary, however, in strength, and are of rather doubtful utility. The rectified spirit precipitates mucilaginous and albumenoid matters, which separate gradually on standing, and are removed by filtration.

SPARTEINÆ SULPHAS — SULPHATE OF SPARTEINE.—$(C_{15}H_{26}N_2)_2,H_2SO_4$ (*not official*).—In colourless rhombohedral crystals; soluble, 3 in 2 of water.

Dose.—$\frac{1}{4}$ to 1 grain.

Therapeutics.—Broom acts as a trustworthy diuretic, its action being consistent and uniform; it is a stimulant diuretic, acting directly on the secretory structure of the kidneys, and is therefore contra-indicated in acute inflammation of these organs. Its official preparations are used as vehicles for, or as adjuncts to enhance the activity of other remedies of a similar class. In large doses they act as emetics and purgatives. They are usually administered in dropsies, especially those of cardiac origin, with tincture of digitalis, &c. The diuretic action has been attributed to *Scoparin*, but this is very doubtful, for it seems to be really inert. There is little doubt that the physiological action and therapeutic value of broom are due to the alkaloid *Sparteine*, which is a narcotic poison. *Sulphate of Sparteine* acts as a valuable cardiac tonic and diuretic, not cumulative, and more prompt though less powerful than digitalis. It slows and strengthens the pulse, and is useful in mitral disease.

Glycyrrhiza glabra—Liquorice.

Botany.—*Root*, perennial, running to a considerable distance. *Stem*, herbaceous, erect, smooth; four to five feet high. *Leaves*, impari-pinnate; leaflets about thirteen, oval, slightly emarginate, viscid underneath. *Flowers*, in axillary racemes, papilionaceous, distant, lilac, bluish, or purplish in colour. *Legume*, compressed, smooth, three to four-seeded. Cultivated at Mitcham in Surrey, and Pontefract in Yorkshire.

GLYCYRRHIZÆ RADIX—*Liquorice Root.*—The root and subterranean stems or stolons, fresh and dried, of *Glycyrrhiza glabra*, Linn.

Characters.—When fresh in long cylindrical pieces of varying thickness, smooth and yellowish-brown or somewhat reddish externally, yellow and juicy internally, very flexible, easily cut, and consisting of a thick cortical portion, surrounding a central woody axis, which, in the case of the stem, contains a small pith. Odour peculiar, earthy, and somewhat sickly; taste strong, peculiar, sweet. When dried it is either peeled or unpeeled. In the latter case it has essentially the same characters as the fresh root, except that it is somewhat darker, furrowed longitudinally, and has a slightly acrid, and, in some cases, feebly bitter taste combined with the characteristic sweetness; but when peeled it has a yellow colour externally, and there is no acridity.

There are three commercial varieties of liquorice root:—(1) *English*, either fresh or in pieces, 3 to 4 inches long, and dried; (2) *Spanish*, in bundles, several feet long, consisting of unpeeled roots and stolons, $\frac{1}{4}$ to 1 inch in thickness; (3) *Russian*, in large bales, consisting of peeled or unpeeled pieces, 12 to 18 inches long and $\frac{1}{4}$ to 2 inches in thickness. It has a slightly bitter taste.

Active Principles.—The persistent sweet taste of liquorice root is due to *Glycyrrhizin* or *Glycyrrhizic Acid*, $C_{44}H_{63}NO_{18}$, an amorphous substance which exists in the root to the extent of 6·3 per cent., apparently in combination with ammonia. It forms salts with metals, and when boiled with dilute acids splits up into *Glycyrrhetin*, $C_{32}H_{47}NO_4$, and *Parasaccharic Acid*, $C_6H_{10}O_8$. The root also contains *Sugar*, *Asparagin*, and an amorphous *bitter principle*, $C_{36}H_{57}NO_{13}$. The root bark contains a little *tannin* and a *resinous oil*, to which its acridity has been attributed.

Official Preparations.

Name.	Part used.	Strength.	Dose.
Extractum.	Root.	...	5 to 60 grains.
„ Liquidum.	„	...	1 drachm.
Pulvis Compositus.	„	1 in 6.	30 to 60 grains.

Used also in *confectio terebinthinæ, decoctum sarsæ co., infusum lini, pilula hydrargyri* and *pilula ferri iodidi.*

EXTRACTUM GLYCYRRHIZÆ—Extract of Liquorice.—*Take of liquorice root, in No.* 20 *powder,* 1 *pound; distilled water,* 4 *pints. Macerate the liquorice root with* 2 *pints of the water for twelve hours, strain, and press; again macerate the pressed marc with the remainder of the water for six hours, strain, and press. Mix the strained liquors, heat them to* 212° F. (100° C.), *and strain through flannel.*[1] *Then evaporate by a water-bath until the extract is of a suitable consistence for forming pills.*

[1] To coagulate albumen, which is strained out. The root yields to cold water from 15 to 20 per cent. of extract.

EXTRACTUM GLYCYRRHIZÆ LIQUIDUM—Liquid Extract of Liquorice.—*Take of liquorice root, in No.* 20 *powder,* 1 *pound; distilled water,* 4 *pints; rectified spirit, a sufficiency. Made by the same process as the solid extract, except that the strained liquid is to be evaporated by a water-bath until it has acquired, when cold, a specific gravity of* 1·160; *add to this one-sixth of its volume of rectified spirit; let the mixture stand for twelve hours, and filter.*[1]

[1] The rectified spirit is added as a preservative. Two fluid ounces of this extract are equal to 1 ounce of the solid extract. Decorticated liquorice yields the finest extract, as it is free from the acrid principle contained in the bark.

PULVIS GLYCYRRHIZÆ COMPOSITUS.—COMPOUND POWDER OF LIQUORICE.—*Take of senna, in fine powder, liquorice root, in fine powder, of each,* 2 *ounces; fennel fruit, in fine powder, sublimed sulphur, of each,* 1 *ounce; refined sugar, in powder,* 6 *ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar.*

Dose.—30 to 60 grains.

GLYCYRRHIZIN AMMONIATUM—AMMONIATED GLYCYRRHIZIN (*not official*).—This is official in the U.S. Pharmacopœia, and is obtained in garnet-coloured shining scales by precipitating the *glycyrrhizin* or *glycyrrhizic acid* with sulphuric acid, purifying, recombining with ammonia, and drying on glass plates. It is soluble in alcohol and water, and possesses the persistent sweet taste of liquorice.

Dose.—5 to 15 grains.

SUCCUS GLYCYRRHIZÆ—SPANISH OR SOLAZZI JUICE—BLACK SUGAR (*not official*).—A solid extract, made by evaporating a decoction of liquorice root. It is found in commerce generally in cylindrical sticks, 6 to 7 inches long and 1 inch thick, stamped at one end with the maker's name. It is sometimes substituted for the official extract, but differs from it in being made with hot water, and containing 30 to 40 per cent. of extractive, insoluble in cold water.

Therapeutics.—Liquorice preparations act as emollients and demulcents, and are given in coughs and bronchial affections, as well as for the purpose of flavouring other medicines. Compound Powder of Liquorice has been adopted from the Prussian Pharmacopœia, and has of late years come into very general use in this country as a mild and agreeable aromatic purgative, suitable for delicate females, and especially so if piles co-exist with the constipation; also for old people, in convalescence from acute disease, and in pregnancy. Properly speaking, however, it ought to be classed with the preparations of senna, as its action is almost entirely due to the senna which it contains. The sulphur and bruised fennel seeds increase its laxative properties, and communicate to it aromatic powers.

The liquid and solid extracts are used as flavouring adjuncts to other medicines, the former being a most efficient adjuvant for disguising the taste of nauseous drugs, such as chloride of ammonium, sulphate of magnesium, quinine, and aloes. *Glycyrrhizin ammoniatum* may be used as an elegant substitute for liquorice in mixtures which are neither acid nor alkaline. The powdered decorticated root is used to stiffen soft pill masses, and also as a dusting powder to prevent them adhering to one another. Liquorice juice is used in various forms as a popular remedy for colds.

Adulterations.—Liquorice root is not subject to adulteration, but commercial samples are frequently inferior, being dry and comparatively insipid. It is probable that much of the root met with is the produce of *Glycyrrhiza Echinata*, but it possesses properties identical with the official root. Solazzi juice is frequently adulterated, and sometimes contains particles of metallic copper. From 60 to 70 per cent. should dissolve in cold water, and the ash should be about 6 or 7 per cent.

Indigofera tinctoria—The Indigo Plant.

INDIGO—INDIGO, C_8H_5NO (probably $C_{16}H_{10}N_2O_2$)—INDIGOTIN —INDIGO-BLUE.—A blue pigment prepared from *Indigofera tinctoria*, Linn., and other species of *Indigofera*.

Characters, &c.—Indigo occurs in cubic cakes of a deep blue colour, which, when rubbed with the nail, assumes a coppery or bronze hue. It is insoluble in water and dilute acids; soluble in aniline and in hot sulphuric acid. The blue colour is destroyed by deoxidising agents, and restored by exposure to the air. Indigo is produced from a colourless glucoside *Indican*, which exists in the plant juice. By fermentation of an aqueous infusion of the fresh plants this is decomposed with production of *Leucindigo* (*Indigo-White*), $C_{16}H_{12}N_2O_2$. By exposure to air and consequent oxidation the *Leucindigo* is converted into *Indigo* (*Indigo-Blue*), which falls to the bottom as an insoluble blue sediment, and is collected, washed, and dried. Commercial Indigo contains from 50 to 60 per cent. of *Pure Indigo* or *Indigotin*, the residue consisting of various colouring matters, &c.

Official Preparation—SOLUTION OF SULPHATE OF INDIGO.—This is a solution of *mono-sulphindigotic acid*, $C_{16}H_9N_2O_2(SO_3H)$, and *disulph-indigotic acid*, $C_{16}H_8N_2O_2(SO_3H)_2$. *See* TEST SOLUTIONS.

Therapeutics.—Indigo has been introduced into the Pharmacopœia solely for the preparation of the solution of the sulphate, which is employed as a test for free chlorine, by which the blue colour is destroyed. Indigo has been used medicinally. Its physiological action, when fully developed, is attended more or less with constriction and heat of the fauces, a metallic taste, nausea, vomiting, diarrhœa (with bluish or blackish liquid stools); the urine assumes a dark brown or violet colour, and, after long use, twitching of the muscles is observed. It has been chiefly recommended as a nervine tonic in spasmodic diseases, convulsions of children, epilepsy, chorea, hysteria, &c. It may be given, in doses of a few grains up to several drachms, as an electuary. Papers impregnated with *Indigo Carmine* (*sulphindigotate of sodium*) are employed for the detection and estimation of sugar in urine.

Adulterations.—Indigo is not infrequently adulterated with lime and various inorganic salts. These may be detected by the proportion of ash, which, in a pure article, should be only about 4·5 per cent.

Myroxylon Pereiræ.—Toluifera Pereiræ, Balsam of Peru Tree.

BALSAMUM PERUVIANUM—*Balsam of Peru.*—A balsam exuded from the trunk of *Myroxylon Pereiræ*, Klotzsch, after the bark has been beaten, scorched, and removed.

A balsam is a resinous or oleo-resinous vegetable secretion, containing *benzoic acid* or *cinnamic acid.* Canada Turpentine and Copaiba are frequently incorrectly called balsams; they contain neither *benzoic* nor *cinnamic acid*, and are, correctly speaking, oleo-resins.

Characters and Tests.—A liquid somewhat less viscid than treacle, appearing nearly black in bulk, but in thin layers deep orange-brown or reddish-brown, and transparent. Its odour is agreeably balsamic, more especially when heated; and when swallowed it leaves a disagreeable burning sensation in the throat. It is insoluble in water, but soluble in chloroform or rectified spirit. Specific gravity between 1·137 and 1·150. Ten drops triturated with 6 grains of slaked lime produces a permanently soft mixture; and the mixture, on being warmed until all volatile matter is given off and until charring commences, gives no fatty odour.[1] It should not diminish in volume when shaken with an equal bulk of water.[2]

[1] This is Fluckiger's test for detection of storax, benzoin, colophony, and copaiba balsam, which give hard, unkneadable masses with lime. Castor oil, if present, gives a soft mixture, but is detecteed by giving off a fatty odour when heated. [2] This is intended to detect alcohol which would dissolve in the water, and thus reduce the bulk of the Peru Balsam.

Active Principles.—Peru Balsam contains small quantities of both *Benzoic* and *Cinnamic Acids;* about 40 to 50 per cent. of a volatile oil. *Cinnamein* (*Benzyl Cinnamate*), C_7H_7, $C_9H_7O_2$, and probably also *benzyl benzoate*, C_7H_7, $C_7H_5O_2$, and a little *benzylic alcohol*, C_7H_7HO); about 38 per cent. (Schlickum, 16 per cent.) of an odourless and tasteless *Resin* (yielding by destructive distillation benzoic acid, styrol, and totuol), and probably some *Styracin* (*cinnamate of cinnamyl*), C_9H_9, $C_9H_7O_2$.

Dose.—10 to 15 minims.

Therapeutics.—See under BALSAM OF TOLU.

Adulterations.—The high price which Balsam of Peru occasionally attains has led to adulteration. The adulterants met with are *alcohol*, detected by shaking up with water; *benzoin* and *storax*, detected by the lime test, or dissolve 5 grams of balsam in 5 grams liquor sodæ (15 per cent.) and 10 grams water; shake up with two successive portions of 15 grams of ether, decanting the ether each time; heat residue to boiling, add excess of HCl, and then cold water. Remove the resin which separates, and dissolve it in 3 grams liquor sodæ (15 per cent.), add 20 grams water, heat to boiling and precipitate with solution of $BaCl_2$. Collect precipitate on a filter, dry on a water-bath, exhaust with alcohol, evaporate off alcohol, dissolve residue in strong H_2SO_4, add chloroform and shake. If even small quantities of benzoin or storax are present the chloroform assumes a violet or blue colour; *castor oil*, detected by test already mentioned or by shaking with an equal volume of benzin (petroleum spirit, boiling point 50° to 60° C.), which does not affect the balsam but dissolves castor oil; *colophony*, detected by Grote's ammonia test, 5 drops balsam shaken with 3 c.c. of liquor ammoniæ froths very little, but with colophony the froth is very abundant, and if the adulteration reaches 20 per cent. the mixture gelatinises in twenty-four hours; *copaiba* and *gurgun balsam* are best detected by their characteristic odour, and the latter imparts a distinct fluorescence to bisulphide of carbon shaken up with the sample. The Balsam of Peru of commerce at the present time is generally of good quality (MacEwan). *Balsamo blanco* (White Balsam) is a soft, yellowish oleo-resin of slightly unpleasant odour obtained from the fruit of *Myroxylon Pereiræ*. *Balsamito* is a sherry-coloured fragrant liquid prepared by digesting the fruit in rum.

Myroxylon Toluifera—Toluifera Balsamum.—The Balsam of Tolu Tree.

Balsamum Tolutanum—*Balsam of Tolu.*—A balsam which exudes from the trunk of *Myroxylon Toluifera* (H. B. and K.) after incisions have been made in the bark.

Characters.—When first imported it is a soft and tenacious solid, but it becomes harder by keeping, and then, in cold weather, is brittle like resin. In thin films it is transparent and of a yellowish-brown colour; and when pressed between pieces of glass with the aid of heat, and then examined with a lens, it exhibits an abundance of crystals of cinnamic acid. Odour highly fragrant, especially when warmed; taste somewhat aromatic and slightly acid. It is soluble in rectified spirit, and the solution has an acid reaction.

Dose.—10 to 20 grains.

Active Principles.—Balsam of Tolu contains about 85 per cent. of a *resin*, $C_{18}H_{20}O_5$, similar to that of Balsam of Peru; about 12 per cent. of a mixture of *Cinnamic Acid*, $HC_9H_7O_2$, and *Benzoic Acid*, $HC_7H_5O_2$; about 1 per cent. of a volatile oil, *Tolene*, $C_{10}H_{16}$; and also some *Cinnamate of Benzyl* and a smaller proportion of *Benzoate of Benzyl*. By destructive distillation it yields the same products as Balsam of Peru.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Syrupus.	Balsam.	About 1 in 29.	1 drachm.
Tinctura.	,,	1 in 8.	20 to 40 minims.

Enters also into the composition of *pilula phosphori* and *tinctura benzoini composita*.

SYRUPUS TOLUTANUS—SYRUP OF TOLU.—*Take of Balsam of Tolu*, $1\frac{1}{4}$ *ounce; refined sugar*, 2 *pounds; distilled water*, 1 *pint, or a sufficiency. Boil the balsam in the water for half an hour in a lightly-covered vessel, stirring occasionally. Then remove from the fire, and add distilled water, if necessary, so that the liquid shall measure* 16 *ounces. Filter the solution when cold,*[1] *add the sugar, and dissolve with the aid of a steam or water bath. The product should weigh* 3 *pounds, and should have the specific gravity* 1·330.

[1] If the solution is filtered before being quite cold, the syrup will have a slightly pungent taste, and there may be after a time a separation of cinnamic or benzoic acid in crystals. The syrup contains *cinnamic* and *benzoic acids*, and its odour and flavour are due to *tolene*, and probably also to the *cinnamate* and *benzoate of benzyl*. Heat causes loss of the volatile constituents; and a full-flavoured syrup may be better made by powdering together Balsam of Tolu, $1\frac{1}{4}$ ounce, and sugar, 8 ounces; macerating in 16 ounces of water for twenty-four hours, frequently agitating, filtering bright, and dissolving in the filtrate, without heat, 24 ounces of sugar (Stephenson).

TINCTURA TOLUTANA—TINCTURE OF TOLU.—*Take of Balsam of Tolu*, $2\frac{1}{2}$ *ounces; rectified spirit, a sufficiency. Macerate the Balsam of Tolu in* 15 *fluid ounces of the spirit, in a closed vessel, with occasional agitation, for six hours, or until the balsam is dissolved, then filter, and add sufficient rectified spirit to make* 1 *pint.*

Therapeutics.—The Balsams of Peru and Tolu act as stimulants and expectorants when given internally, and as stimulants and detergents when applied to wounds and sores externally. The circulation is increased in activity, and the secretion of the bronchial mucous membrane is more readily discharged under their influence. They appear to have a predilection for the mucous membrane of the air-passages, as copaiva has for the genito-urinary tract. They are employed chiefly in old-standing affections of the bronchial mucous membrane,—as in chronic catarrhs, habitual winter coughs, &c., especially when there is torpor or debility of constitution. In consequence of their stimulant action they are contra-indicated in acute inflammatory affections. They are available in some chronic asthmatic cases. They, and their official preparations, may be employed as agreeable adjuvants to other stimulating expectorants, but Peru Balsam is rarely given internally, and Tolu Balsam is seldom given alone. Externally, Balsam of Peru is employed in alopœcia, indolent and foul ulcers, &c. An ointment of Balsam of Peru 1, lard 7, forms an excellent application for sore nipples or cracked lips. A mixture of equal parts Balsam of Peru and resin ointment is applied on cotton-wool to bed-sores.

Adulterations.—Balsam of Tolu is not often adulterated. Common resin or colophony is sometimes mixed with it, and may be detected by warm bisulphide of carbon, which dissolves colophony but removes only benzoic and cinnamic acids from Balsam of Tolu. Pure Balsam dissolves to a red liquid in strong H_2SO_4; colophony, if present, would char, swell up, and give off sulphurous acid fumes. A spurious Balsam of Tolu containing 63 per cent. of storax has been met with. It is so different from the true Balsam in appearance and odour as to be readily detected.

Physostigma venenosum.—Calabar Bean Plant.—Eséré-Nut Plant.

PHYSOSTIGMATIS SEMEN—PHYSOSTIGMATIS FABA—*Calabar Bean.*—Eséré-Nut, or Ordeal-bean of Old Calabar; the seed of *Physostigma venenosum*, Balfour.

Characters.—From 1 to 1¼ inch long, ¾ inch broad, and ½ an inch or somewhat more in thickness; oblong, and more or less reniform, and with a long, broad, blackish furrow running entirely along its convex side.[1] Testa hard, brittle, roughish, deep chocolate-brown or brownish-red, and enclosing a closely-adhering nucleus, which principally consists of two hard, white, brittle cotyledons, separated from each other by a somewhat large cavity. Inodorous, and no marked taste beyond that of an ordinary bean. It yields its virtues to alcohol and imperfectly to water. The cotyledons when moistened with solution of potash acquire a permanent pale yellow colour.

Dose in Powder.—1 to 4 grains.

[1] This is intended to exclude the seeds of *Physostigma cylindrospermum*, which are longer and more cylindrical, and the furrow or hilum does not extend more than three-fourths along the convex side of the seed.

Active Principles.—Calabar beans contain about 0·2 per cent. of the alkaloid *Physostigmine* or *Eserine*, $C_{15}H_{21}N_3O_2$; also a physiologically antagonistic alkaloid, *Calabarine;* a third alkaloid, *Eseridine*, $C_{15}H_{23}N_3O_3$, and a neutral crystalline body, *Phytosterin*, $C_{26}H_{44}O$, resembling *Cholesterin.*

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Seeds.	...	$\frac{1}{16}$ to $\frac{1}{4}$ grain.
Physostigmina.	"	...	$\frac{1}{100}$ to $\frac{1}{50}$ grain.
Lamellæ Physostigminæ.	Alkaloid.	$\frac{1}{1000}$ grain.	1 disc.

EXTRACTUM PHYSOSTIGMATIS—EXTRACT OF CALABAR BEAN.—*Take of Calabar bean, in coarse powder,* 1 *pound; rectified spirit,* 4 *pints. Macerate the bean for forty-eight hours with* 1 *pint of the spirit in a close vessel, agitating occasionally, then transfer to a percolator, and when the fluid ceases to pass, add the remainder of the spirit, so that it may slowly percolate through the powder. Subject the residue of the bean to pressure, adding the pressed liquid to the product of the percolation; filter, distil off most of the spirit, and evaporate what is left in the retort by a water-bath to the consistence of a soft extract.*

This is an alcoholic extract prepared by maceration and percolation. It has been found to vary much in alkaloidal strength, but averages about 5 per cent. A menstruum containing 66 per cent. of alcohol yields four times as much extract, containing 2·6 per cent. of alkaloid. It is evident, therefore, that such a menstruum exhausts the seeds more efficiently than rectified spirit.

PHYSOSTIGMINA—PHYSOSTIGMINE OR ESERINE—$C_{15}H_{21}N_3O_2$. —An alkaloid obtained from alcoholic extract of Calabar bean by a process similar to that given for *Cocaine.*

Characters and Tests.—In colourless or pinkish (large rectangular) crystals, slightly soluble in water, but readily soluble in alcohol, ether, and in diluted acids. The aqueous solution has an alkaline reaction; when warmed with or shaken with dilute solution of potash becomes red,[1] and when evaporated to dryness over a water-bath leaves a bluish residue, the acidified solution of which is beautifully dichroic, being blue and red.[2] Physostigmine causes contraction of the pupil of the eye.

[1] The red colour is due to *Rubreserine*, an inert body produced by oxidation of the *Physostigmine*. [2] Ammonia is necessary for the production of the bluish residue and dichroic solution.

LAMELLÆ PHYSOSTIGMINÆ—DISCS OF PHYSOSTIGMINE.—Similar to Discs of Cocaine, and containing in each $\frac{1}{1000}$ grain of Physostigmine.

The following non-official salts are also employed:—

Physostigmine Hydrobromas, $C_{15}H_{21}N_3O_2HBr$. *Dose.*—$\frac{1}{60}$ to $\frac{1}{12}$ grain; *Physostigminæ salicylas*, $C_{15}H_{21}N_3O_2$, $HC_7H_5O_3$. *Dose.*—$\frac{1}{60}$ to $\frac{1}{12}$ grain; *Physostigminæ sulphas*, $(C_{15}H_{21}N_3O_2)_2H_2SO_4$. *Dose.*—$\frac{1}{60}$ to $\frac{1}{12}$ grain. The hydrobromate and sulphate are freely soluble in water, and the salicylate 1 in 140.

Therapeutics.—Professor Christison was the first to give an account of the physiological effects of the Calabar bean in the human subject, and he bought his experience by an experiment upon himself (see *Pharmaceutical Journal* [o.s.], vol. xiv. p. 474). It stimulates both voluntary and involuntary muscular fibre, and paralyses the nerve-centres. The prominent symptoms after a full dose of the bean may be briefly described as giddiness, great muscular prostration, lessened heart action, contraction of the pupil, intellectual faculties unaffected, sometimes vomiting, more commonly purging.

To Professor T. R. Fraser is due the credit of investigating most thoroughly the properties of the Calabar bean, and his results may be thus summarised:—1. The Calabar bean, when acting as a poison, may produce death either, first, by paralysis of respiration—*Asphyxia;* or, second, by first diminishing the frequency of the heart's action, and then, finally, stopping its contractions—*Syncope.* 2. The paralysis resulting seems to be due to an action upon the spinal cord as a *reflex centre*, and not to be owing to any effect either upon the spinal nerves or the cerebrum. 3. Its cardiac effect is most probably due, not to any increase of the inhibitory power of the vagus, but to its paralysing the exciting ganglia of the heart. 4. Physostigma, however, after a time paralyses the motor or efferent spinal nerves, its action in so doing commencing in their peripheral extremities, like conium and curare. It does not seem to exert any paralytic action upon afferent or sensory nerves. 5. The effect on the smaller blood-vessels is, first, contraction, and afterwards dilation. Large doses at once arrest cardiac movements ; smaller doses make them grow less quickly feeble. Immediately after the administration of the poison, there usually occurs a slight fall in the arterial tension. This is followed by a distinct rise in both arterial and venous pressure, but subsequently a rapid diminution of pressure in both arterial and venous systems supervenes. 6. The pupil is found alternately to dilate and contract. At the moment of death it is found contracted, but immediately afterwards it is found to dilate.

The alkaloids of Calabar bean, *Physostigmine* and *Eseridine*, paralyse the nervous centres and stimulate muscular fibre, the latter having only one-sixth of the power of the former. *Calabarine*, on the other hand, possesses antagonistic properties, and causes convulsions like *strychnine*. The action of the bean is practically the same as that of *Physostigmine*, and considering the variable strength of the extract, and the possible interference of the antagonistic *calabarine*, the use of the pure alkaloid is to be preferred. In small doses its action on the muscular fibre of the stomach and intestines causes pain in the abdomen, with nausea, vomiting, increased peristalsis, and diarrhœa ; and its action on the vagus and motor centres produces a sense of oppression in the chest and weakness. Larger doses intensify these symptoms, and induce contraction of the pupil, salivation, slowness of the pulse, and finally death, due to paralysis of the respiratory centre in the medulla. The spinal cord and medulla are paralysed; sometimes there may be convulsions due to the *calabarine*. After a time the motor nerves, and partially also the sensory nerves, are paralysed. The brain is not paralysed, but there appears to be irritation with cerebral excitement. Respiration is first quickened from stimulation of the ends of the vagi in the lungs, and then retarded from paralysis of the respiratory centre in the medulla. Small doses sometimes cause a slight fall in blood pressure, larger ones always cause a rise, due to the increased contractile power of the heart, the pulsation being slower and more powerful. Its stimulant action on the cardiac muscular fibre is so great that neither irritation of the vagus nor of the venous sinus can stop the heart. The action of the drug on the heart is counteracted by *atropine*, and, though to a less extent, the action of *atropine* is counteracted by *Physostigmine*. Physostigma increases the secretions from the salivary, sweat, lachrymal, and mucous glands, and restores the excitability of the chorda tympani after its secretory fibres have been paralysed by *atropine*. It is a powerful myotic, and when locally applied to the eye it causes contraction of the pupil, diminishes intra-ocular tension, and induces spasm of accommodation, preceded by increased power of accommodation for near objects; twitching of the eyelids and slight supra-orbital pain are often observed. These effects appear to be due to stimulation of either the fibres of the third nerve or the circular muscular fibres of the iris (Lauder Brunton). The employment of this agent is beneficial in certain diseases of the eye, such as:—1*st*, In cases of paralysis of the circular fibres of the iris and of the accommodation, such as are apt to follow exposure to cold, or to occur in the course of diphtheria, continued fever, or other debilitating diseases; 2*nd*, To remove dilation of the pupil and paralysis of accommodation after the application of *atropine* or belladonna to the eye; 3*rd*, To diminish the amount of light admitted to the eye in cases of acute inflammation of choroid or retina; 4*th*, In cases of penetrating ulcers or wounds at the peripheral part of the cornea, with the view of preventing or reducing prolapse of the iris; 5*th*, To reduce intra-ocular tension in glaucoma and staphyloma; and 6*th*, Alternately with *atropine* to break down adhesions after iritis. For local application the *lamellæ physostigminæ* are a very convenient and portable form, each disc being sufficient for a single application. They are to be applied, by means of a fine moistened camel's-hair pencil, to the conjunctiva where they are dissolved by the tears, and produce their due effect. Calabar bean is employed for tetanus, when it should be given either by the mouth, rectum, or hypodermically, in repeated doses, increased every hour, so as to produce paralysis little short of arresting respiration. It is also used in general paralysis of the insane, and mania; in paraplegia, locomotor ataxy, and constipation due to atony of the intestinal walls; and has been recommended in bronchitis, catarrh, and dyspnœa when due to weakness of the bronchial muscles. It is an antidote to *atropine* and *strychnine*. *Antidote.*—Evacuate the stomach by an emetic, and inject *atropine* (4 minims of the liquor every quarter of an hour) until the pulse quickens or the symptoms pass off. Care must be taken not to give too great a dose of *atropine*, as an excess seems to intensify the lethal action of the *Physostigmine*.

Adulterations and Substitutions.—The seeds of *Physostigma cylindrospermum*, Cali nuts or wild Calabar beans, are sometimes found in commerce. They appear to possess similar properties to the official seed, but are reputed to be more powerful. They are detected by he characters already mentioned, and by the application of liquor potassæ to the naked cotyledon. The official seed when so treated gives a permanent pale yellow colour, while the Cali nut gives an orange colour, turning to greenish. The seeds of several species of *Mucuna*, and of the Oil Palm, *Elais guineensis*, have been found mixed with Calabar beans, but the characters of the latter are so distinctive that such admixtures are readily detected.

Pterocarpus Marsupium — Bastard Teak — East Indian or Malabar Kino Tree.

KINO—*Kino—Malabar Kino.*—The juice obtained from incisions made in the trunk of *Pterocarpus Marsupium*, Roxb. Inspissated without artificial heat.

A perpendicular incision with lateral ones leading into it is made in the trunk. The red juice exudes, and is collected in a vessel placed at the lower end of the main incision. It is dried by exposure to the sun and air, broken into fragments, and packed in wooden boxes for exportation.

Characters.—In small angular glistening opaque reddish-black brittle fragments, which in thin laminæ and at the edges are transparent and ruby red; inodorous, very astringent, and when chewed sticking to the teeth and tinging the saliva blood red.[1] Almost entirely soluble in rectified spirit. It yields little or nothing to ether.

Dose.—10 to 30 grains.

[1] Bengal Kino does not stick to the teeth, and is only soluble to the extent of about 46 per cent. in rectified spirit.

Active Principles.—Chemically, Kino closely resembles the official Catechu. It contains *Pyro-catechin*, *Kino-tannic Acid*, and *Kino-red.*

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Pulvis Compositus.	Kino.	1 in $1\frac{1}{3}$.	5 to 20 grains.
Tinctura.	„	1 in 10.	$\frac{1}{2}$ to 2 drachms.

Used also in *Pulvis Catechu Compositus.*

PULVIS KINO COMPOSITUS — COMPOUND POWDER OF KINO.—*Pulvis Kino cum Opio*, 1864. *Take of Kino, in powder,* $3\frac{3}{4}$ *ounces; opium, in powder,* $\frac{1}{4}$ *ounce; cinnamon bark, in powder,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle. It contains* 1 *grain of opium in* 20 *grains.*

TINCTURA KINO—TINCTURE OF KINO.—*Take of Kino, in coarse powder,* 2 *ounces; glycerine,* 3 *fluid ounces; distilled water,* 5 *fluid* *ounces; rectified spirit,* 12 *fluid ounces. Macerate for seven days in a closed vessel, with occasional agitation; filter, and add sufficient rectified spirit to make* 1 *pint.*

The tincture of the previous Pharmacopœia, made with rectified spirit alone, sometimes became gelatinous on standing. The addition of glycerine and water is said to obviate this result, but this has been denied. Some samples of Kino seem more prone to gelatinization than others.

Therapeutics.—Kino is a less powerful astringent than catechu, although it contains a larger quantity of tannic acid, because Kino tannic acid is less soluble than that which is present in catechu, but resembles it in its medicinal properties. It is used as a pure astringent in chronic diarrhœa and dysentery, in combination with chalk and opiates. It is also employed for the sake of its astringency in chronic mucous discharges, and also in passive hæmorrhages. It has been found serviceable in pyrosis, and in some forms of dyspepsia. As a topical astringent it is used as a gargle or injection, and also as an application to flabby ulcers. It is given in cases associated with general debility, and is contra-indicated in inflammatory states.

Adulterations and Substitutions.—The general name of Kino is applied to a number of similar astringent inspissated juices, some of which are occasionally substituted for the official *East Indian* or *Malabar Kino.* The principal varieties are :—1. *African* or *Gambia Kino*, from *Pterocarpus erinaceus*, closely resembles the official, but is not now found in commerce. 2. *Bengal Kino* or *Butea Gum*, from *Butea frondosa*, detected by the characters already mentioned. 3. *Australian*, *Botany Bay*, or *Eucalyptus Kino*, from *Eucalyptus rostrata* and other species, closely resembles official Kino, but is of a more marked reddish colour, and sometimes contains a gum insoluble in rectified spirit. 4. *West Indian* or *Jamaica Kino*, from *Coccoloba uvifera*, has a bitterish taste, and the powder is much lighter than that of official Kino. 5. *South American* or *Curaccas Kino*, botanical source unknown, closely resembles the West Indian variety, and is distinguished from the official Kino by being more irregular, less sharply angular, more powdery, and less black. Black Catechu, from *Acacia Catechu*, broken into small fragments, is said to have been sold as Kino. It may be detected by being partially soluble in ether and not tinging the saliva blood-red when chewed.

Pterocarpus Santalinus—Chandam—Red Sanders-Wood, Ruby-Wood, or Red Sandal-Wood Tree.

Pterocarpi Lignum—*Red Sandal-Wood—Red Sanders-Wood.*—The sliced or rasped heart-wood of *Pterocarpus santalinus*, Linn. fil.

Characters.—As imported, it is in dense heavy irregular logs varying in length and thickness, dark reddish-brown or blackish-brown externally, and internally, if cut transversely, deep blood-red variegated with zones of a lighter red colour. It is usually found in the pharmacies in the form of raspings or small chips, which are deep reddish-brown in colour, very slightly astringent in taste, and when rubbed of a faint peculiar odour.

Active Principles.—It is to be noted that Red Sandal-Wood possesses none of the odorous properties of the wood of *Santalum album.* The colouring matter is said to be *Santalin* or *Santalic Acid*, $C_{15}H_{14}O_5$ (?) ($C_{14}H_{12}O_4$, Weidel), a resinoid body possessing acid properties, insoluble in water, fixed oils and turpentine, soluble in alcohol, ether, alkaline solutions, and acetic acid. A colourless crystalline body *Santal*, $C_8H_6O_3$; two crystalline bodies *Pterocarpin*, $C_{10}H_8O_3$, and *Homopterocarpin*, $C_{12}H_{12}O_3$, and an *amorphous body* having the formula $C_{17}H_{16}O_6$, have also been obtained. A complete research seems necessary to elucidate the constitution and relationship of the various constituents reported to exist in the wood.

Official Preparation for which Red Sandal-Wood is Used.—Tinctura Lavandulæ Compositus.

Therapeutics.—Though used in India as an astringent, Red Sandal-Wood does not possess any medicinal virtue, and is only employed in pharmacy to colour compound tincture of lavender and liquor arsenicalis. It is largely used as a dye-stuff for silk, cotton, and wool.

Adulterations or Substitutions.—Logwood or Brazil Wood may be mistaken for Red Sandal-Wood. They are readily known by imparting a red colour to cold water, which does not extract the colouring matter of Red Sandal-Wood. The colouring matter of Alkanet Root is soluble in fixed oils and turpentine, and that of Red Sandal-Wood insoluble.

Sub-Order II.—Cæsalpiniæ.

Cassia acutifolia—The Alexandrian or Nubian Senna Plant.

Cassia angustifolia—The East Indian or Tinnivelly Senna Plant.

Senna Alexandrina—*Alexandrian Senna.*—The dried leaflets of *Cassia acutifolia*, Delile (*Cassia lanceolata*, Nectoux); imported from Alexandria, sometimes in a more or less contaminated condition, in which case the true senna leaflets should be carefully separated from all extraneous matter.

SENNA INDICA—*East Indian* or *Tinnivelly Senna.*—The dried leaflets of *Cassia angustifolia*, Vahl (*Cassia elongata*, Lem-Lisanc). From plants cultivated in Southern India; imported without admixture of other leaves or extraneous matters of any kind.

Characters.—1. *Alexandrian Senna.*—About ¾ to more than 1 inch long, lanceolate or oval lanceolate, acute, unequal at the base, entire, thin, brittle, pale yellowish-green, evidently veined on the lower surface, and very finely pubescent or nearly smooth. 2. *East Indian Senna.*—About 1 to 2 inches long, lanceolate, acute, unequal-sided at the base, thin, entire, yellowish-green and smooth above, somewhat duller beneath, and glabrous or slightly pubescent. Both varieties have a peculiar, faint, tea-like odour, and a mucilaginous, nauseous, and sickly taste.

Dose.—In powder, 10 to 30 grains.

Active Principles.—*Cathartic Acid*, a glucoside, splitting up under the influence of dilute mineral acids into *Cathartogenic Acid* and *Glucose*, is the principle to which senna chiefly owes its purgative properties. It is very unstable, and its chemical formula has not been accurately determined; but it contains only C, H, and O, and the formula given by Kubly, $C_{180}H_{96}N_2SO_{82}$, must have been arrived at by examination of an impure substance. It forms salts with metals, the magnesium salt being soluble in water. Senna is said to contain also a yellow colouring matter, *Chrysophan*, an unfermentable sugar, *Catharto-mannite*, $C_{42}H_{44}O_{38}$ (?), and two bitter principles, *Sennacrol* and *Sennapicrin*. Strong spirit does not remove any cathartic acid from the leaves, but does remove some constituents which appear to assist their therapeutic action.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Confectio.	Dried Leaves.	1 in 11.	1 to 2 drachms.
Infusum.	"	1 in 10.	1 to 2 ounces.
Mistura Composita.	"	...	1 to 1½ ounce.
Syrupus.	"	1 in 2.	1 to 4 drachms.
Tinctura.	"	1 in 8.	1 to 4 drachms.

Enters also into the composition of *pulvis glycyrrhizæ compositus.*

CONFECTIO SENNÆ—CONFECTION OF SENNA—(Lenitive Electuary).—*Take of senna, in fine powder*, 7 *ounces; coriander fruit, in fine powder*, 3 *ounces; figs*, 12 *ounces; tamarind*, 9 *ounces; cassia* *pulp*, 9 *ounces; prunes*, 6 *ounces; extract of liquorice*, 1 *ounce; refined sugar*, 30 *ounces; distilled water, a sufficiency. Boil the figs and prunes gently with* 24 *ounces of distilled water in a covered vessel for four hours, then, having added more distilled water to make up the quantity to its original volume, mix the tamarind and cassia pulp, digest for two hours, and rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts. To the pulped product add the sugar and extract of liquorice, and dissolve them with a gentle heat; while the mixture is still warm, add to it gradually the mixed senna and coriander powders, and mix the whole thoroughly, making the weight of the resulting confection* 75 *ounces, either by evaporation or by the addition of more distilled water.*

INFUSUM SENNÆ—INFUSION OF SENNA.—*Take of senna*, 1 *ounce; ginger, sliced*, 28 *grains; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

This infusion, said to be the most active preparation, is generally slightly acid and rapidly spoils. It keeps better if a little sodium bicarbonate is added to it.

MISTURA SENNÆ COMPOSITA—COMPOUND MIXTURE OF SENNA—(Black Draught).—*Take of sulphate of magnesium*, 4 *ounces; liquid extract of liquorice*, 1 *fluid ounce; tincture of senna*, $2\frac{1}{2}$ *fluid ounces; compound tincture of cardamoms*, $1\frac{1}{2}$ *fluid ounces; infusion of senna*, 15 *fluid ounces. Dissolve the sulphate of magnesium in the infusion of senna, with the aid of a gentle heat, then add the liquid extract and the tinctures.*

The product measures $22\frac{1}{4}$ fluid ounces, and contains 1 ounce magnesium sulphate in $5\frac{1}{2}$ fluid ounces, not 1 in 5 as stated in the *B.P.*

SYRUPUS SENNÆ—SYRUP OF SENNA.—*Take of senna, broken small*, 16 *ounces; oil of coriander*, 3 *minims; refined sugar*, 24 *ounces; distilled water*, 5 *pints, or a sufficiency; rectified spirit*, 3 *fluid ounces. Digest the senna in* 70 *ounces of the water for twenty-four hours at a temperature of* 120° F. (48°·9 C.); *press out the liquor and strain it. Digest the marc in* 30 *ounces of the water for six hours at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to* 10 *fluid ounces, and, when cold, add the rectified spirit, previously mixed with the oil of coriander. Clarify by filtration, and wash what remains on the filter with distilled water until the washings make up the filtrate to* 16 *fluid ounces. Then add the sugar, and dissolve by means of a gentle heat. The product should weigh* 2 *pounds* 10 *ounces, and should have the specific gravity* 1·310.

This is really a sweetened aqueous fluid extract, and is frequently sold as such. The rectified spirit precipitates albuminoids and mucilage, and acts as a preservative. The heating during evaporation is objectionable, as it decomposes the *cathartic acid.* A more active syrup can be prepared by repercolation without heat, or by the *B.P.C.* process for Elixir Senna. The deodorised fluid extract of the *American Formulary* is made by first removing from the leaves the constituents soluble in strong alcohol, and then preparing a fluid extract from them with a mixture of equal parts alcohol and water.

TINCTURA SENNÆ—TINCTURE OF SENNA.—*Take of senna, broken small,* 2½ *ounces; raisins, freed from seeds,* 2 *ounces;*[1] *caraway fruit, bruised, coriander fruit, bruised, of each,* ½ *ounce; proof spirit,* 1 *pint.*

Made by the same process as tincture of aconite.

[1] Raisin seeds contain *tannin,* which would impart astringency to the tincture.

This tincture is said to be inert, because proof spirit does not dissolve *cathartic acid.* Equal parts of rectified spirit and water is recommended, as giving a more active tincture.

ELIXIR SENNÆ (*B.P.C.*)—ELIXIR OF SENNA—(*not official*).—*Take of senna,* 16 *ounces; sugar,* 12 *ounces; rectified spirit and distilled water, of each, a sufficiency. Mix* 4 *fluid ounces of the spirit with* 12 *fluid ounces of water, and with it moisten evenly the senna. Pack tightly in a closed vessel, and macerate for three days. Express and pour the product on the sugar. Break up the marc, and add to it sufficient of the same menstruum to furnish in all* 16 *fluid ounces of product. Express again after twenty-four hours' maceration, add the liquor to the previously obtained product and the sugar, heat in a closed vessel, by means of a water-bath, to* 200° F., *and maintain that temperature for ten minutes. When cold, strain and add, previously mixed, chloroform,* 24 *minims; oil of coriander,* 2½ *minims; tincture of capsicum,* 30 *minims; rectified spirit,* 3 *fluid drachms; agitate thoroughly, and, if necessary, add proof spirit to make the product measure* 24 *fluid ounces.*

Dose.—1 to 3 fluid drachms.

EXTRACTUM SENNÆ FRUCTUUM LIQUIDUM—FLUID EXTRACT OF SENNA PODS—(*not official*).—*Made by exhausting senna pods with very dilute alcohol by repercolation or double maceration and expression, so that* 1 *fluid ounce of extract represents* 1 *ounce of senna pods. Sometimes flavoured with essential oils like syrup of senna.*

Dose.—½ to 2 fluid drachms.

Therapeutics.—Senna acts as a safe, energetic, and somewhat stimulant purgative, but is apt to produce nausea, griping, and flatulence; it is, however, seldom given alone, and by a judicious combination with carminatives these unpleasant effects may be controlled. It operates chiefly upon the *small intestines,* causing copious watery evacuations, it increases the mucous secretion as well as the peristaltic contractions, it is a mild, drastic purgative, but, unlike most medicines of that class, it is not poisonous in large doses. It probably stimulates the abdominal and pelvic vessels, thereby increasing catamenial and hæmorrhoidal discharges. As an active purge it is useful in constipation, especially in head cases, as it is somewhat of an irritant and derivative. It is better adapted to persons of leucophlegmatic than to those of nervous temperament. It is contra-indicated in menorrhagia, threatening abortion, in certain conditions of the uterus and rectum tending to prolapsus, and in inflammatory affections of the stomach and bowels. In most other cases it is a safe and useful remedy for persons of all ages. The infusion is a suitable vehicle for saline purgatives, a useful remedy in constipation being the Mistura Sennæ Co., where it is combined with sulphate of magnesia. In habitual constipation and hæmorrhoids Confectio Senna has been much used, but it has now been displaced by Pulvis Glycyrrhizæ Co., the active constituents of which are sulphur and senna. This is a very convenient form, and in regular doses of 1 drachm taken at bedtime usually keeps the bowels open without acting too violently. The quantity of sulphur in each dose seems small, but it causes an increase of flatus in the intestine, which appears to facilitate the expulsion of its contents. Recently a fluid extract of the fruit or pods of senna has been recommended as having the advantage of being free from the nauseous odour and flavour of the leaves. It is equally certain in its action, though somewhat slower, and does not cause griping or other unpleasant symptoms.

Adulterations and Substitutions.—Alexandrian Senna, as imported, is now usually of better quality than formerly, though frequently contaminated with the leaf-stalks, flowers, broken twigs, and legumes of the official plant. The leaflets of *Cassia obovata, Wild Senna*, or *Senna Baladi*, official in the 1867 *B.P.*, but very inferior, and now excluded, recognised by oblong-obovate outline and often macronate apex; *Argel leaves* from *Solenostemma Argel* recognised by paler colour, leathery texture, less conspicuous veins, equal-sided base, and very bitter taste; leaflets of *Tephrosia Apollinea*, rarely seen, recognised by obovate-oblong outline, emarginate apex, silky appearance, and equal-sided base; together with the flowers and fruits of *Argel*, date stones and other impurities are also frequently present. These, however, are usually removed by sifting, fanning, and picking, by the importers or dealers, and the leaves as met with in pharmacy are usually unadulterated. The most serious adulteration is that of *Argel leaves*, which possess griping properties.

East Indian Senna or *Tinnivelly Senna.*—This variety is carefully cultivated and harvested. It is shipped generally from Tuticorn in Southern India, and is entirely free from adulteration. *Cassia angustifolia*, the plant yielding *East Indian Senna*, grows wild in Southern Arabia, where it yields a very inferior senna, consisting of smaller more or less broken leaflets, often brown and decayed, mixed with flowers, pods, and stalks, and known as *Arabian*, *Mocha*, *Bombay*, or *Indian Senna.* The leaflets are distinguished from *Alexandrian Senna* by their greater length and narrowness.

Cassia Fistula—Purging Cassia Tree—Indian Laburnum.

CASSIÆ PULPÆ—*Cassia Pulp.*—The pulp obtained from the recently-imported pods of *Cassia Fistula*, Linn.

Characters.—The pods are from 1½ to 2 feet long, about 1 inch in diameter, shortly stalked, pointed, blackish-brown, very hard, indehiscent, the sutures marked by two smooth longitudinal bands; divided internally by thin, transverse partitions into numerous cells, each containing a solitary smooth flattish-oval reddish-brown seed more or less surrounded by pulp, and hence the pods should not rattle when shaken. The pulp is viscid, blackish-brown, sweet in taste, and somewhat sickly in odour. When obtained separately the pulp frequently contains the seeds and the partitions or dissepiments; these should be removed when it is used for pharmaceutical purposes.

Active Principles.—Cassia pulp contains about 60 per cent. of *sugar*, but no peculiar principle has been found in it. It contains also *mucilage*, *albuminoids*, and crystals of *oxalate of calcium.*

Official Preparation.—Confectio Sennæ, 1 in 8 nearly.

Therapeutics.—Cassia pulp in small doses is laxative, in larger doses purgative, often causing nausea, griping, and flatulence. It is rarely used alone, but may be given in doses of sixty to one hundred and twenty or more grains to children, and in larger doses to adults; as a laxative in febrile and inflammatory cases.

Adulteration or Substitutions.—The pods of other species are sometimes imported. Those of *Cassia grandis*, a native of Central America and Brazil, are used in veterinary medicine, and known as Horse Cassia. They are longer and of greater diameter (sometimes 1½ inch), laterally compressed, rough externally, and marked by three longitudinal prominent ridges. The pods of *Cassia moschata*, native of New Granada, closely resemble the official pods but are smaller, less regularly straight, when crushed and exposed to heat of water-bath give odour like sandal-wood, and the pulp is coloured blackish-green by ferric chloride.

Copaifera Langsdorfii—The Copaiba or Copaiva Tree.—The principal source of Copaiba, found growing wild over a wide area in Brazil.

COPAIBA—*Copaiva*, *Copaiba*, or *Capivi*.—The oleo-resin obtained by cutting deeply or boring into the trunk of *Copaifera Langsdorfii*, Desf., and other species of *Copaifera*. Commonly but erroneously called Balsam of Copaiba.

Characters and Tests.—A more or less viscid liquid; generally transparent and not fluorescent, but some varieties are opalescent, and occasionally slightly fluorescent;[1] light yellow to pale golden brown, having a peculiar aromatic odour, and a persistent acrid, somewhat bitter taste. Its specific gravity varies from 0·940 to 0·993.[2] A small quantity heated until all volatile oil is removed yields a residue which when cold is hard, and generally easily rubbed to powder;[3] and the oil volatilised during the operation does not smell of turpentine.[4] Almost entirely soluble in absolute alcohol,[5] and in four times its bulk of petroleum spirit, the latter solution only yielding a filmy deposit on standing.[5]

[1] West Indian Copaiba is generally opalescent. [2] The density increases with age owing partly to volatilisation, and partly to oxidation of the volatile oil. [3] Indicating absence of fixed oils. [4] Indicating absence of turpentine. [5] Indicating absence of Venice Turpentine and Gurjun Balsam.

The oleo-resin is contained in resiniferous ducts in the stem, in which it occasionally accumulates to such a degree as to forcibly burst the trunk. There are several varieties of copaiba met with in commerce, such as Para, Maranham, Maracaibo, and West Indian. These so closely resemble each other that they can only be distinguished by experienced judges.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

Active Principles.—Copaiba contains from 40 to 60 per cent. of *volatile oil* (see below), the remainder consisting of a brownish, brittle *amorphous acid resin*, which forms only amorphous salts. Some samples of copaiba yield crystalline *Copaivic Acid*, $C_{20}H_{32}O_2$ (?). The Para variety yields crystalline *Oxycopaivic Acid*, $C_{20}H_{28}O_3$, and the Maracaibo variety yields crystalline *Metacopaivic Acid*, $C_{22}H_{34}O_4$.

Official Preparation.—Oleum Copaibæ.

OLEUM COPAIBÆ—OIL OF COPAIVA.—The oil distilled from copaiva.

Characters.—Colourless or pale yellow, with the odour and taste of copaiva.

This is the essential constituent of copaiba. It is a lævo-rotatory *terpene* having the formula $C_{20}H_{32}$, specific gravity 0·9, boiling-point 250° to 260° C., soluble 1 in 20 of rectified spirit, freely in absolute alcohol.

Dose.—5 to 20 minims.

RESINA COPAIBÆ—COPAIVA RESIN—(*not official*).—The residue left after distillation of the oil. It is official in the *U.S. Pharmacopœia.*

Dose.—15 to 20 grains as a diuretic in almond emulsion.

Therapeutics.—Copaiva acts as a general and topical stimulant, occupying a place between the balsams and the turpentines. In medicinal doses it creates a feeling of warmth in the stomach, and is generally followed by unpleasant eructations, nausea, and sometimes by vomiting; it may also cause severe griping and purging. In over-doses it is apt to cause severe gastric irritation, vomiting, griping and purging, headache, hot skin, thirst, and sometimes ischuria and hæmaturia. It is excreted by the lungs and kidneys, and imparts its odour to the breath and to the urine. An eruption upon the skin, varying somewhat in character, but resembling urticaria or measles, is apt to follow the internal use of copaiva; it is distinguished by the absence of fever, it does not begin on the face and spread downwards, but is patchy, and prefers the neighbourhood of joints, and disappears if the copaiva is withheld. To make sure, test the urine. On the addition of nitric acid a milkiness is produced, from precipitation of copaivic acid, somewhat resembling albumen, but differs in being soluble by heat. Copaiva acts as a stimulant to the mucous membrane generally, but especially to the genito-urinary tract, and is chiefly used as a remedy for gonorrhœa. Some practitioners employ it in the early and inflammatory stage of this disease, it is better to wait until the acute symptoms have subsided. Copaiva forms a conjugate glycuronic acid in the system, which is eliminated by the kidneys, and renders the urine antiseptic, so that it does not readily decompose, and is not favourable to bacterial organisms. It seems probable that the efficacy of the drug in diseases of the bladder and urethra is due to the washing out of the urinary passages with antiseptic urine; this explains why it is not so useful in the treatment of gonorrhœa in the female as in the male, because in the former the vagina, with which the urine does not come in contact, is the principal seat of the inflammation, and also why copaiva injected locally is not successful. In other inflammatory affections of the same tract of mucous membrane, copaiva is sometimes used with advantage, as in catarrhus vesicæ, but it must be stopped at once if it gives rise to increased irritation of the bladder. It may also be given in leucorrhœa ; but it is to be remembered that it imparts a certain odour to the breath and urine, which is not generally considered creditable. It is also given in chronic affections of the pulmonary mucous membrane of an exhausting character, attended by profuse expectoration, and along with digitalis in cardiac dropsy ; but it is only in old-standing cases without inflammatory symptoms, in persons of debilitated and torpid constitution, that the stimulating effects of copaiva can be tolerated. The oil of copaiva is much less efficient than the oleo-resin, the resin may be given as a diuretic in dropsy. Copaiva may be given dropped upon sugar ; made into pills with calcined magnesia or hydrate of lime ; made into emulsion with mucilage (℥iss. to ℥i. of copaiba), or with alkalies, or with yolk of egg ; floated upon cinnamon or peppermint water flavoured with tincture of orange-peel ; in gelatine capsules ; or in other forms ; the object being to disguise its taste as much as possible. It may be combined with other drugs to prevent the griping and purging which it sometimes occasions.

Adulterations or Substitutions.—Copaiba is somewhat frequently adulterated either with turpentine or fixed oils. Of these the most frequent is castor-oil, which is less easily detected on account of its solubility in alcohol. A sample containing it gives a soft oily residue when the volatile oil is distilled off. Turpentine is detected by the odour when a drop of the copaiba is allowed to fall on a hot plate. Gurjun Balsam or Wood Oil, an oleo-resin (see page 231), has been substituted for copaiba, which it very closely resembles in appearance and therapeutic properties. It may be recognised by its very marked fluorescence, which gives it an opaque, dingy, greenish-grey appearance when seen by reflected light, and by the fact that when heated to about 130° C. it gelatinises so that the vessel containing it may be inverted without any of the contents escaping. Copaiba when so treated remains fluid. One drop of copaiba dissolved in nineteen drops of carbon bisulphide gives a reddish-brown colour when shaken with one drop of a mixture of equal parts of strong sulphuric and nitric acids ; Gurjun Balsam gives an intense purplish-red, changing to violet. This test will readily show the presence of 12 per cent. of Wood Oil in Copaiba. Copaiba gives a clear solution with petroleum ether, but if castor-oil, Venice turpentine, linseed oil, or Gurjun Balsam are present a milky mixture is produced.

Hæmatoxylon Campeachianum—The Logwood or Peachwood Tree.

HÆMATOXYLI LIGNUM—*Logwood* or *Peachwood.*—The sliced heart-wood of *Hœmatoxylon campechianum*, Linn.

Characters.—The logs, in which form it is imported, are hard, heavy, blackish-red externally, and internally reddish-brown. The chips, as directed to be used, have a reddish-brown colour, a slight peculiar agreeable odour, and a sweetish astringent taste. When chewed they colour the saliva a brilliant dark reddish-pink colour.

There are four commercial varieties of logwood, viz., Campeachy, Honduras, San Domingo, and Jamaica. The first two are richest in *hæmatoxylin*, and should be preferred for pharmaceutical purposes. Logwood chips, as generally met with, have been subjected to fermentation by being moistened with water and placed in heaps for from four to six weeks. By this process the colourless *hæmatoxylin* is changed into the colouring matter *hæmatein*, and thus the chips become much more valuable as a dye-stuff. The change, however, destroys their therapeutic value, which is due to the *hæmatoxylin.* Siebold has pointed out that the official characters are misleading; the colour is that of the fermented article, but the sweetish taste is characteristic only of the unfermented wood. He strongly recommends that the latter only should be used in pharmacy.

Active Principles.—Logwood contains from 9 to 12 per cent. of *hæmatoxylin*, $C_{16}H_{14}O_6$, a colourless crystalline substance, to which it owes its sweetish astringency, and which by fermentation or exposure to the atmosphere in presence of ammonia or fixed alkali is decomposed with production of the colouring matter, *hæmatein*, $C_{16}H_{12}O_6$, to which the value of the wood for dyeing purposes is due. It also contains a small quantity of *tannin.*

Official Preparations.

Name.	Parts Used.	Strength.
Decoctum.	Sliced wood	1 in 20
Extractum.	”	”

DECOCTUM HÆMATOXYLI—DECOCTION OF LOGWOOD.—*Take of logwood, in chips,* 1 *ounce; cinnamon bark, in coarse powder,* 55 *grains; distilled water,* 1 *pint. Boil the logwood in the water for ten minutes in a covered vessel, adding the cinnamon towards the end.*[1] *Strain the decoction and pour as much distilled water over the contents of the strainer as will make the strained product measure* 1 *pint.*

[1] To avoid loss of volatile oil.

EXTRACTUM HÆMATOXYLI—EXTRACT OF LOGWOOD.—*Take* *of logwood, in fine chips,* 1 *pound; boiling distilled water,* 1 *gallon. Infuse the logwood in the water for twenty-four hours, then boil down to one-half, strain, and evaporate to dryness by a water-bath, stirring with a wooden spatula. Iron vessels should not be used.*

This extract should be specially prepared, and care should be taken to avoid too high a temperature during evaporation, otherwise resinous and other insoluble substances may be produced from the *hæmatein.* The extract imported for technical purposes is not pure enough for medicinal use, and is frequently much adulterated.

EXTRACTUM HÆMATOXYLI LIQUIDUM (*B.P.C.*)—LIQUID EXTRACT OF LOGWOOD—(*not official*).—*Take of unfermented logwood, in No.* 16 *powder,* 20 *ounces, distilled water,* 6 *pints. Boil the logwood with* 2 *pints of water in a covered copper or enamelled pan for half an hour, and strain. Add* 2 *pints of water, boil for another half hour, and again strain. Repeat the process for a third time, and having mixed the strained liquors, evaporate over a water-bath* (*or preferably* in vacuo) *until the product measures* 1 *pint. Set aside for seven days, and then decant the clear liquor by means of a syphon from any sediment that may have been deposited.*

Dose.—$\frac{1}{2}$ to 2 fluid drachms.

This preparation was suggested by Siebold as preferable to the solid extract, which cannot be readily prepared without destruction of *hæmatoxylin* by the heat required to dry it.

Therapeutics.—The ordinary uses of logwood are those of an astringent in chronic diarrhœa and diarrhœa of phthisis, with opium and sulphuric acid, in dysentery, in hemorrhages, in hyper-mucus secretions, &c. It has the advantage as a remedy in the diarrhœa of children of not causing subsequent constipation. It has been recommended for the purpose of arresting the sweating of phthisis, and also in diabetes. From the absorption of its colouring matter the urine is tinged. As an injection, it is used in leucorrhœa. Logwood is extensively employed in dyeing, producing violet and blue colours, certain shades of grey, and especially blacks of a lustrous, velvety cast. *Hæmatoxylin,* which occurs in yellowish granular crystals, sparingly soluble in water, freely in alcohol, is used for staining histological specimens.

Adulteration.—*Brazil Wood,* the produce of various species of *Cæsalpinia,* resembles logwood externally, and is said to be occasionally mixed with logwood chips. It contains a colouring principle, *Brasilin,* $C_{22}H_{20}O_7$, which strikes a *red* colour with alkalis; *hæmatoxylin* gives a *bluish-purple.*

Tamarindus Indica—The Tamarind or Tintiree Tree.

TAMARINDUS—*Tamarind.*—The preserved pulp of the fruit of *Tamarindus indica*, Linn.

There are two commercial varieties of *Tamarinds*, known as *West Indian* and *East Indian* respectively. *West Indian*, *Brown*, or *Red Tamarinds* consist of the shelled fruits packed in a cask or jar along with powdered sugar, or the fruits are placed in the cask or jar, and boiling syrup poured over them. The West Indian variety thus preserved is alone official. *East Indian* or *Black Tamarinds* are usually preserved without sugar, and occur as a firm, clammy, brownish-black mass of pulp and seeds, mixed with fibres and fragments of the shells, and having a very acid taste.

Characters and Test.—A reddish-brown moist sugary mass, enclosing strong-branched fibres and brown shining seeds, each enclosed in a tough membranous coat. Taste agreeable, refreshing, sub-acid. A piece of bright iron, left in contact with the pulp for an hour, does not exhibit any deposit of copper.[1]

[1] The tamarinds are sometimes prepared in copper vessels, by which they would be contaminated.

Active Principles.—No principle possessing laxative properties has been found in tamarinds. Their acidity is due to *tartaric*, *citric*, and *acetic acids*, either free or combined with potash. They contain also *grape-sugar* and *pectin.*

Official Preparation.—Confectio Sennæ, 9 in 75.

Therapeutics.—Tamarind pulp acts as a refrigerant and laxative, and is given occasionally in febrile attacks. Tamarind whey, or an infusion of tamarinds, may be given as a refrigerant drink. But the pulp is seldom used alone, and is chiefly employed as an ingredient in confection of senna. *Black Tamarinds* are said to be used in the manufacture of tobacco.

SUB-ORDER.—MIMOSEÆ.

Acacia Senegal—The Gum Acacia, Verek, or Hashab Tree.

ACACIA GUMMI—*Gum Acacia.*—A gummy exudation from the stem and branches of *Acacia Senegal*, Willd., and from other species of *Acacia.*

The gum exudes spontaneously, but sometimes the flow is promoted by making incisions.

Characters and Tests.—In roundish, ovoid, or vermicular tears or masses of various sizes ; or in angular fragments with glistening surfaces, colourless, or with a yellowish, brownish, or reddish tint. The tears either opaque from numerous minute fissures and very brittle, or more or less transparent and not easily broken, the fractured surfaces vitreous in appearance. Taste bland and mucilaginous; without odour; insoluble in alcohol,[1] but entirely soluble in water, and forming a clear mucilaginous solution. The aqueous solution forms with subacetate of lead an opaque white jelly.[2] If an aqueous solution of iodine be added to the powder,[3] or to a solution formed with boiling water and cooled, there is no appearance of a violet or blue colour.[4]

[1] One of the *Brazilian Gums*, resembling acacia gum, is a gum resin soluble in alcohol. [2] *Dextrin* or *British Gum* is not precipitated by basic lead acetate. [3] *Tragacanth* gives violet or blue colour. [4] Starch gives a blue colour.

A great variety of *Acacia* gums are met with in commerce, all of which are now made official, if they answer to the pharmacopœial characters and tests. The following are the principle varieties:—
1. *Picked Turkey* or *White Sennaar Gum*. This is the finest variety of gum. It occurs in white, opaque, fissured brittle masses, and is the produce of *Acacia Senegal*, being obtained from Kordofan, in the Central Soudan, and collected in the districts to the west of the White Nile. Since the recent political disturbances in that locality, the supply of this gum has been stopped. 2. *Aden*, *Geddah*, *Suakim*, *Gehzirah*, *Senari*, and *Talca Gums*, from *Acacia stenocarpa*, are inferior varieties produced in the countries to the east of the White Nile, and between it and the Red Sea. *Gehzirah Gum* gives a bluish mucilage. 3. *Senegal Gum*, from *Acacia Senegal*, is the name applied to the gum produced in the French settlements on the Senegal River in North-West Africa. It is obtained from the same tree which yields the Kordofan Gum, and may be distinguished by being in large elongated or vermicular, yellowish, or reddish lumps, transparent, and not readily broken. There are three commercial varieties, viz., "*gomme du bas de fleuve*," "*gomme de Galam*," and "*gomme friable*," the second being the cleanest and best. 4. *Barbary*, *Morocco*, or *Mogadore Gum*, from *Acacia arabica*, is collected in Morocco and the adjoining countries. There are three varieties, viz., *White Barbary*, *Barbary Amrad*, and *Brown Barbary*, the first being the best. It has been alleged that the *White Barbary Gum* is probably *Kordofan Gum*, which has been brought from the Central Soudan by a new route. Some reddish coloured consignments of gum have recently been received from the Congo River district. 5. *Cape Gum*. There are two commercial varieties—*Glassy Hard Brown Cape*, from *Acacia horrida*, amber coloured, giving a dark, viscid mucilage, with a characteristic flavour. This gum is sometimes bleached and mixed

with pale gums. *Soft Cape Gum*, from *Acacia giraffæ* (?), contains dark brown pieces, and gives a mucilage having a bitter taste. There is also a fine picked *White Cape Gum* which closely resembles *Kordofan Gum*. 6. *East Indian Gums*. These are said to be the produce of *Acacia arabica*, but it is difficult to trace the source of them. The varieties are *Glassy amrad*, pale amber or light brown, smooth and glistening, probably a mixture, gives a very viscid mucilage; *Pale amrad*, surface rough and opaque, gives a thin mucilage; *East Indian fine amrad*, gives mucilage too dark for pharmaceutical purposes; *East Indian amrad*, mucilage gives dark brown colour with ferric chloride, indicating presence of tannin; and *East Indian red amrad*, gives a dark brownish-black mucilage, having an offensive odour, and giving a black colour with ferric chloride, indicating abundance of tannin. 7. *Australian* or *Wattle Gum*, obtained from *Acacia pycnantha* and other species, varies in colour from pale yellow to reddish-brown, and gives a thin but very adhesive mucilage, that from the darker gums containing frequently a little tannin derived from portions of bark present in the gum. 8. *Brazilian Gum*, *Gum Angico*, or *Para Gum*, occurs in large dark amber or brown transparent masses, and gives a thick but only moderately adhesive mucilage. It is said to be obtained from *Acacia Angico*. It must not be confounded with a gum-resin obtained from *Hymenæa Courbaril* (Leguminosæ), which is imported as *Brazilian Gum*. The latter resembles copal, and is used for varnishes. 9. *Oomra Gum*. This is an Indian gum, of which there seems to be two varieties. The most important is *Ghátí* or *Ghátti Gum*, which occurs in brownish-yellow or colourless aud transparent rounded or vermiform pieces, which give a mucilage much thicker than that of *Acacia* Gum, and having a peculiar mawkish flavour. It appears to be derived principally from *Anogeissus latifolia*, and is therefore not an *Acacia* Gum. The other variety is *Babool* or *Amrad Gum*, said to be derived from *Acacia arabica*, and differing from other gums in not being precipitated by either neutral or basic lead acetate. Dark coloured gums are unsuitable for pharmaceutical purposes. Turkey Gum is at present not obtainable, its place being taken by picked *Cape Gum*. Next in value comes *Senegal Gum*, then *Barbary Gum*, then the paler varieties of *East Indian Gum*, and then *Ghátí Gum*. Maben suggests a method for recognising the different gums by means of reagents, see *Pharmaceutical Journal*, [3], xx. p. 720.

Active Principles.—Gum arabic may be taken as a type of the class substances called gums. They are degradation products of plant life, produced by a destructive change in the cellulose of the cell walls. They consist of an organic acid in combination with an alkali or alkaline earth, and are either soluble in water, as in the case of gum arabic (arabin), or they merely swell up in it and form a gelatinous mucilage, as in the case of tragacanth (bassorin). Gum arabic consists of *arabic* or *gummic acid*, $C_{89}H_{142}O_{74}$, in combination with calcium, magnesium, and potassium, the main constituent being *arabinate of calcium*, $C_{89}H_{142}O_{74}CaO$. It contains also from 12 to 17 per cent. of water, and yields from 2·7 to 4 per cent. of ash. Some samples give a glairy or ropy mucilage, a condition due apparently to the presence of free *arabic acid*. The addition of a little free alkali renders the mucilage clear.

Official Preparations containing Gum Acacia.

Name.	Part Used.	Strength.
Mist. Cretæ.	Gum.	1 in 34
„ Guaiaci.	„	1 in 85
Mucilago Acaciæ.	„	1 in 2½
Pulv: Amygd: Co:	„	1 in 13
„ Tragac: Co:	„	1 in 6

Enters also into all the *Trochisci.*

MUCILAGO ACACIÆ—MUCILAGE OF GUM ACACIA.—*Take of gum acacia, in small pieces,* 4 *ounces; distilled water,* 6 *fluid ounces. Put the gum and water into a covered earthen jar, and stir them frequently until the gum is dissolved. If necessary, strain the solution through muslin.*

Dose.—Ad libitum.

Therapeutics.—Gum arabic acts topically as a demulcent and emollient; it does not produce any apparent constitutional effects, but is supposed to diminish irritation of the urinary passages, probably acting only as a diluent in virtue of the water taken along with it. It is given to allay cough and irritation of the throat and air-passages; to allay irritation of the genito-urinary mucous membrane, and to protect the stomach in irritant poisoning. Topically, a thick solution has been recommended as an application to burns and scalds, to chapped nipples, &c.; and powdered gum has been successfully employed, blown into the nostril, to arrest epistaxis. But it is chiefly employed for pharmaceutical purposes, to suspend heavy, oleaginous, or resinous insoluble substances in mixtures or emulsions; to form lozenges, certain pill masses, &c.

Adulterations and Substitutions.—Various substances, such as insoluble cherry-tree gum (cerasin), bdellium, &c., are frequently found in parcels of *Acacia* Gum, and may be detected by their insolubility in water. *Feronia* or *Wood-Apple Gum*, the produce of *Feronia Elephantum*, and *Ghátí* or *Ghátti Gum*, are also sometimes mixed with or wholly substituted for *Acacia Gum*. The former may be distinguished by not giving a precipitate with borax, and by being precipitated by neutral acetate of lead. The latter, which forms a good substitute, may be recognised by giving a mucilage in the proportion of 1 to 3 of water even more viscid than the official Mucilago Acaciæ, and this mucilage only gives a faint opalescence with ammonium oxalate. *Dextrin*, broken into small fragments, is sometimes mixed with parcels of gum. It gives a neutral mucilage, that of gum arabic being acid, and is not precipitated by either ferric chloride or basic acetate of lead, both of which precipitate gum arabic. Flour, starch, dextrin, or inferior gums are sometimes mixed with powdered gum arabic. The two first mentioned are detected by the iodine test, dextrin by the test already mentioned, and inferior gums by the dark colour of the powder and the mucilage made from it.

Abrus precatorius—Indian Liquorice (*Papilionaceæ*)—(*not official*). —The seeds of this common Indian plant, known as *Prayer Beads*, *Jumble Beads*, *Gumchi*, *Retti* or *Ratti*, or *Jequirity Seeds*, are about the size of a common pea, of a scarlet colour, with a black patch around the hilum, very hard, and difficult to powder. Two nitrogenous principles have been separated from the seeds *paraglobulin* and *a-phytalbuminose*. The latter is a pepsin-like ferment, said to be identical with *papain*. *Infusum Abri*—*Jequirity seeds*, in powder, 2 ; water, at 120° F., 25 ; allow to stand till cold and decant the supernatant liquid. Apply 3 times a day, and repeat on the second and third day if required. The root has been used in India as a substitute for ordinary liquorice, but has a disagreeable odour and a bitterish-acrid flavour.

Therapeutics.—Jequirity seeds are innocuous when eaten, but act as an irritant poison when placed in wounds or under the skin in animals. The infusion, applied to the eyelids, produces purulent ophthalmia, and is so applied for the cure of granular lids, epithelioma, lupoid growths, sloughy ulcers, and asthenic ulcers of the cornea. The irritant action which produces ophthalmia has been attributed to a bacillus, but it is probably caused by the *a-phytalbuminose*, or some similar pepsin-like ferment.

Arachis hypogea—The Monkey Nut, Ground Nut, Earth Nut, Pea Nut, or Mundubi Plant (*Papilionaceæ*) (*not official*).—This plant is largely cultivated in Western Tropical Africa and in India for its seeds, commonly known as *ground nuts* or *earth nuts*. These are used as food, and by expression yield from 42 to 50 per cent. of *fixed oil*, the *oleum arachis* of commerce. The finer varieties of this oil are white, bland, tasteless, nearly neutral, and keep for a long time without becoming rancid. It consists of glycerides of *oleic*, *hypogæic*, *palmitic*, and *arachic acids*, and closely resembles olive oil, for which it has been extensively substituted in pharmacy, especially in India.

Baptisia tinctoria—Wild Indigo (*Papilionaceæ*)—(*not official*) —*Habitat*, U.S., America.—The root, especially the cortical portion, yields the eclectic remedy *Baptisin*, which is a powdered extract, and is employed in doses of 1 to 5 grains as a purgative and emetic in typhus and gangrene. In small doses it is a mild laxative, and in large doses a powerful emetic and cathartic. It is a moderately powerful hepatic and intestinal stimulant. The root contains *Baptisin*, an indifferent bitter glucoside; *Baptin*, a glucoside having feeble laxative properties; and *Baptitoxine*, an alkaloid possessing active poisonous properties. The eclective remedy *Baptisin* is probably a mixture of all three substances.

Dipteryx odorata—Coumaruma odorata (*Papilionaceæ*)—(*not official*)—*Habitat*, Guiana.—The fruit consists of an oblong-ovate pod, containing a single seed, from 1 to 1½ inch long, and 2 to 4 lines broad, usually slightly compressed, with a dark brown, unwrinkled, shining, thin, and brittle skin, and a light brown, oily kernel. The seeds, known as Tonka or Tonquin Beans, have a very powerful and agreeable odour due to *Coumarin*, $C_9H_6O_2$, a neutral crystalline principle, which may be obtained in colourless rectangular plates. *Coumarin* is now made synthetically from *Salicylol*, or *Salicylic Aldehyde*. In the proportion of 1 part to 50 of Iodoform it is used to disguise the odour of the latter.

Mucuna pruriens — Cowhage — Kiwach (*Papilionaceæ*) — (*not official*)—*Habitat*, East and West Indies.—Cowage, Cowhage, or Cowitch (probably a corruption of the Indian name *Kiwach*) was recognised in the three former Pharmacopœias, and was referred to as the Fructus Pubes (L.), Hairs from the Pod (E.), and the Hairy Down (D.), of *Mucuna* or *Dolichos pruriens* of De Candolle. This plant is a twining shrub; the legume, or siliqua hirsuta, is from 3 to 5 inches long, about the thickness of the finger, roundish, peculiarly curved, containing from four to six seeds, and covered with strong, bristling, stinging hairs. These hairs constitute the medicinal part of the plant, and when examined under the microscope, are seen to be finely pointed, and serrated towards their points. The pods are imported with the hairs attached, and both are of brown colour and stiff; but before they are ripe, when they are still soft and tender, the pods are used as an article of diet in India.

Therapeutics.—Cowhage is an example of a medicine acting purely mechanically. When the hairs are applied to the skin, they produce intolerable itching, and sometimes redness, swelling, and an eruption. Rubbing or scratching the part only renders their effects more severe; but the application of a little oil allays the irritation by protecting the parts, just as the mucus of the alimentary passages protects the mucous membranes from their irritating influence when the drug is given internally. The only medicinal use of Cowhage is to act as a vermifuge, which it does by mechanically irritating the worms. It is most useful in dislodging the round worm, *Ascaris lumbricoides*, but may also be given for the threadworm, *Ascaris vermicularis;* it often fails to interfere with the tapeworm, *Tænia*, for the removal of which other remedies are more efficient. Cowhage is usually a safe remedy, but severe enteritis has been known to follow its exhibition. The mode of administration is first to dip the pods into treacle or honey, and then to scrape the hairs from them into one or other of these substances as a vehicle, until it has the consistency of an electuary. Of this preparation, a teaspoonful to a tablespoonful—the former to a child, the latter to an adult—may be given before breakfast for two or three mornings, after which a brisk purgative must be administered to carry off the worms. A decoction of the legumes was formerly used as a diuretic in dropsies.

Piscidia erythrina—Jamaica Dogwood (*Papilionaceæ*)—(*not official*)—*Habitat,* West Indies.—The root bark is used as a fish poison in the West Indies, and as a remedy for toothache in America. It is a good narcotic and general sedative. Inasmuch as it does not induce headache or constipation, nor interfere with expectoration, or lower the vital force, it is an effective substitute for opium in allaying pain, spasm, and nervous excitement, and in producing tranquil sleep. It is specially useful in allaying the cough in bronchitis and phthisis. It may be used in the form of *Extractum Piscidiæ Liquidum* (strength, 1 in 1), in doses of 20 minims to 2 fluid drachms.

Acacia Catechu—The Catechu Acacia—Khair or Kher (*Mimosea*)—(*not official*)—*Habitat,* India.

CATECHU NIGRUM—Black Catechu.—An extract of the heart-wood of *Acacia Catechu*, Wild.; imported from Pegu. Catechu Nigrum, formerly official, is made up in masses consisting of layers enveloped in rough leaves of Dipterocarpus turbinatus. These masses are of a blackish-brown colour, shining, heavy, bitter, and very astringent. When softened in water and examined with a microscope, it shows an abundance of small acicular crystals of *Catechin* or *Catechuic acid*. It is called by the natives Kut or Kutch, and consists essentially of a mixture of *Catechin* or *Catechuic Acid*, and *Catechu-tannic* or *Mimotannic Acid*. During the season for preparing it the manufacturers live in tents in the jungle. Selecting suitable trees, they cut their duramen or heart-wood into small chips, and place them with a little water in small earthen pots, arranged in a double row upon a fireplace built of mud. When a certain quantity of the water has been dissipated by boiling, the clear decoction is removed and strained into another series of pots, when it is evaporated to a proper consistence, and then poured into clay moulds. This variety of Catechu is in no respect therapeutically different from the pale or official variety (see *Uncaria Gambier*).

Trigonella Fœnum-græcum—Fenugreek, Helbeh, Methi (*Papilionaceæ*)—(*not official*)—*Habitat*, India and Egypt.—Fenugreek seeds are small, hard, angular, more or less shrivelled, light brown or brownish-yellow externally, yellow internally; somewhat oily or farinaceous, bitterish, with a strong peculiar odour, suggesting *coumarin*. They are very mucilaginous, but not now used medicinally in this country. The powdered seeds are used as an ingredient in curry powder; in veterinary practice; for flavouring concentrated cattle foods; and to render damaged hay palatable.

Acacia farnesiana—Sweet-smelling Acacia (*Mimoseæ*).—The flowers of this species have a very sweet, violet-like odour, due to a volatile oil which is the essential ingredient in the delicious *cassie essence* and *cassie pomade* of commerce.

Erythrophlœum guineense—The Sassy Tree (*Mimoseæ*)—(*not official*)—*Habitat*, Western Africa.

ERYTHROPHLŒI CORTEX—Casca, Sassy, Mancona Ordeal, or Doom Bark.—The bark of this large tree occurs in more or less curved pieces, with or without epidermis, in the former case fissured externally, of a dull red colour with whitish spots, brittle, and presenting when cut numerous fawn-coloured spots surrounded by reddish-brown tissue; nearly inodorous, astringent, usually sinking in water. It is a powerful poison, and the powder when inhaled causes violent sneezing. Internally the infusion or tincture causes vomiting and purging. It acts on the circulation and kidneys like digitalis, and produces convulsions like *picrotoxin.* The active principle is an alkaloid, *Erythrophlœine*, of which the hydrochlorate has been prepared in yellowish-white granular crystals, readily soluble in water; the solution having an acrid, bitter taste, and combining the actions of *digitalin* and *picrotoxin.* Casca Bark has been found useful in dilated heart, without valvular disease, and in mitral disease and cardiac dropsy. It has the disadvantage of disturbing the digestion more readily than digitalis. The Tinctura Erythrophlœi, *B.P.C.* (1 in 10 of rectified spirit—*Dose*, 5 to 10 minims), is the most convenient preparation.

Nat. Ord. **ROSACEÆ**—The Rose Order.—Trees, shrubs, or herbs, inhabiting various parts of the world, but chiefly the temperate climates. The plants of the order vary in their medicinal properties; in some cases the barks and roots are astringent; the seeds, flowers, leaves, and young shoots of many of the plants furnish hydrocyanic or prussic acid, and are occasionally poisonous. Many of the plants supply succulent, edible fruits.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Prunus Amygdalus.	Ripe seed.	Spain and Morocco.
Prunus domestica.	Dried fruit.	France.
Prunus Laurocerasus.	Fresh leaves.	Indigenous.
Hagenia abyssinica.	Dried panicles.	Abyssinia.
Rosa cannia.	Ripe fruit.	Indigenous.
Rosa centifolia.	Fresh petals.	Indigenous.
Rosa gallica.	Fresh and dried petals.	Cultivated in Britain.

Prunus Amygdalus—The Almond Tree.—Of this tree there are two distinct varieties—*Prunus Amygdalus*, var. *amara*, yielding bitter almonds; *Prunus Amygdalus*, var. *dulcis*, yielding sweet almonds.

Amygdala amara—*Bitter Almond.*—The ripe seed of the bitter almond tree, *Prunus Amygdalus*, var. *amara*, Stokes. Imported chiefly from Mogadore.

Characters.—Resembles the sweet almond in appearance, but is distinguished by being broader and shorter, by its very bitter taste, and by its aqueous emulsion having an odour like that of ratafia or peach-blossoms. Almonds are distinguished commercially in the order of their value as *French*, *Sicilian*, and *Barbary*.

Active Principles.—Bitter almonds are the principal source of the official *oleum amygdalæ*, a *fixed oil*, of which they yield by expression about 44 per cent. They contain from 2½ to 3 per cent of a neutral, bitter substance, *Amygdalin*, $C_{20}H_{27}NO_{11}$, which may be obtained in pearly scales or thin prisms from the bitter almond cake left after expression of the fixed oil, by boiling it with alcohol, filtering, concentrating, and precipitating the *amygdalin* by the addition of ether. *Amygdalin* is a glucoside, and was the first body of this class to be discovered (1837). Glucosides may be defined as solid, neutral, or acid; usually crystalline organic substances soluble in water, and which, when decomposed by dilute acids, baryta water, dilute alkalis, or nitrogenous ferments, in presence of water, yield glucose (or some other sugar) and another substance not belonging to the class of carbo-hydrates. They are mostly natural products occurring in plants, but some have been obtained artificially. Both bitter and sweet almonds contain an albuminoid substance, *Emulsin*, which may be obtained by leaving an aqueous extract of almond cake at 23° C. for a few days, filtering, and adding alcohol, which precipitates the *Emulsin* as a neutral, white amorphous mass, soluble in water. *Emulsin* belongs to the class of complicated organic bodies known as chemical or unorganised ferments or *enzymes*. These bodies exist in many vegetable and animal tissues, and have the power of converting glucosides, in presence of water, into glucose and another body or bodies. Thus *Amygdalin*, in presence of water, is converted into *volatile oil* of bitter almonds (*benzoic aldehyde*), *hydrocyanic acid*, and *glucose*, as shown in the following equation :—

$$\underset{\text{Amygdalin.}}{C_{20}H_{27}NO_{11}} + 2H_2O = \underset{\text{Benzoic Aldehyde.}}{C_7H_6O} + \underset{\text{Hydrocyanic Acid.}}{HCN} + \underset{\text{Glucose.}}{2C_6H_{12}O_6}.$$

The chemical change in this case is one of hydrolysis, in which the water is split into hydroxyl and hydrogen, the former going to the *glucose* and the latter to the other substance. The *Emulsin* itself appears to be unacted on, and simply induces molecular change by contact. Heat and all chemicals which coagulate albumen stop such fermentation by destroying the hydrolytic power of the *Emulsin*. The characteristic odour of an emulsion of bitter almonds is due to the formation of the *volatile oil* and *hydrocyanic acid* in the manner above described. These bodies therefore do not exist in the seeds, but are formed by fermentation on the addition of water. The seeds yield about 0·8 per cent. of *volatile oil* and about 0·2 per cent. of *hydrocyanic acid.*

Official Preparation.—OLEUM AMYGDALÆ.

OLEUM AMYGDALÆ—ALMOND OIL.—The oil expressed from the bitter or sweet almond.

Characters.—Thin, pale yellow, nearly inodorous, with a bland, oleaginous, nutty taste. By exposure to air it soon becomes rancid. Almond oil is sometimes adulterated with poppy oil and other drying oils. These are detected by not solidifying on the addition of nitric acid as almond oil does. Colza oil is detected by darkening on the addition of nitrate of silver to an ethereal solution. Oils of peach and apricot kernels give a deep red-yellow colour when mixed with 25 per cent. of nitric acid, almond oil remaining white.

Enters into the composition of *oleum phosphoratum, unguentum cetacei, unguentum resinæ, and unguentum simplex.*

OLEUM AMYGDALÆ AMARÆ—(*not official*)—OIL OF BITTER ALMONDS, VOLATILE OR ESSENTIAL OIL OF ALMONDS.—This volatile oil is a neutral, colourless or yellowish, thin liquid, of a peculiar aromatic odour, and a bitter burning taste, and is obtained from the cake left after expression of the fixed oil by mixing it with water and distilling. The crude volatile oil contains from 8 to 12 per cent. of *hydrocyanic acid,* which may be removed as Prussian blue by shaking up the crude oil with ferrous sulphate and slaked lime. The purest oil is obtained by shaking up the crude product with a saturated solution of sodium bisulphite, with which the oil forms a crystalline compound. The crystals are washed with alcohol, recrystallised from water, and decomposed by distillation with solution of sodium carbonate. The oil is also largely prepared synthetically from chlorinated derivatives of *toluene,* C_7H_8. The specific gravity of the crude oil is 1·06 to 1·08 ; that of the purified oil, 1·05. The pure oil is known chemically as *Benzoic aldehyde* or *Benzaldehyde,* $C_6H_5CO.H$, and readily yields *benzoic acid* by oxidation on exposure. The pure oil, both natural and synthetic, is more prone to oxidation than the crude. The presence of hydrocyanic acid prevents this change, and is on that account frequently added to the synthetic product. Oxidation may also be avoided by removing the last traces of moisture by digestion with calcium chloride.

Therapeutics.—Bitter almonds are poisonous, producing effects similar to those of poisoning by hydrocyanic acid. In small quantities they cause nausea, vomiting, purging, and a peculiar eruption like nettle-rash. In large quantities they produce serious and even fatal results. An emulsion of bitter almonds is useful in some skin diseases, such as herpes, acne, prurigo, &c. They are also sometimes used for flavouring, but are mainly employed for expressing the fixed oil of almonds. The ground cake, *almond powder*, is used as a soap for the hands, to remove the odour of camphor, musk, creasote, asafœtida, &c., from utensils, and as a lute. *Almond Oil* possesses the medicinal and dietetic properties common to fixed oils, and is employed in pharmacy in the preparation of ointments. *Volatile oil of almonds* in the crude state is highly poisonous, owing to the presence of hydrocyanic acid. Its effects are practically the same as those of hydrocyanic, but its composition is so variable that it is very rarely used medicinally. It has, however, been prescribed in doses of from $\frac{1}{4}$ to 1 drop in emulsion, and has been employed externally in prurigo senilis. It is very largely employed in perfumery for scenting toilet soaps, &c., and by the cook and confectioner as a flavouring agent. For the latter purpose the purified oil (*Oleum Amygdalæ Amaræ* sine *Acido Hydrocyanico*) only should be used, and for this purpose an essence of bitter almonds or almond flavour (oil 1, rectified spirit 3) is commonly supplied. The purified oil is also employed to conceal the taste of cod-liver oil and castor oil. It is non-poisonous.

Adulterations or Substitutions.—Bitter almonds are frequently adulterated by an admixture of sweet almonds, thus causing loss to the oil presser, whose profit depends on the percentage of volatile oil obtainable from the residual almond cake. The *expressed oil* is sometimes mixed with other oils (see page 320). The *volatile oil* is liable to admixture with or entire substitution of *nitrobenzene*, *essence of mirbane*, or (from its odour) *artificial oil of bitter almonds* $C_6H_5NO_2$. The specific gravity of the latter is 1·18 to 1·20, and a sample showing an abnormally high density would therefore be suspected. If 1 part of oil, 4 parts alcohol, and 1 part fused caustic potash are heated for a few minutes, evaporated to one-third, and cooled, the mixture should dissolve with only slight turbidity in water. If a brownish-yellow sediment is deposited, then the sample contains *nitrobenzene*. The absence of hydrocyanic acid in commercial, purified, or synthetic oil may be proved by distilling at a low temperature and applying the Prussian blue test to the first portion of the distillate.

It is convenient to place here the officinal diluted hydrocyanic acid, although it is not derived from a vegetable source.

Acidum Hydrocyanicum Dilutum—Diluted Hydrocyanic Acid

—Prussic Acid—Hydrocyanic Acid, HCN, dissolved in water, and constituting 2 per cent. by weight of the solution.

PREPARATION.—*Take of ferrocyanide of potassium,* 2¼ *ounces; sulphuric acid,* 1 *fluid ounce; distilled water,* 30 *fluid ounces, or a sufficiency. Dissolve the ferrocyanide of potassium in* 10 *ounces of the water, then add the sulphuric acid, previously diluted with* 4 *ounces of the water and cooled. Put the solution into a flask or other suitable apparatus of glass or earthenware, to which are attached a condenser and a receiver arranged for distillation; and having put* 8 *ounces of distilled water into the receiver, and provided efficient means for keeping the condenser and receiver cold, apply heat to the flask, until by slow distillation the liquid in the receiver is increased to* 17 *fluid ounces. Add to this* 3 *ounces of distilled water, or as much as may be sufficient to bring the acid to the required strength, so that* 100 *grains (or* 110 *minims of it), precipitated with a solution of nitrate of silver, and the precipitate thoroughly washed and dried, shall yield* 10 *grains of dry cyanide of silver.*

Diluted hydrocyanic acid should be kept in well-corked bottles, tied over with impervious tissue. The bottles should be inverted when not in use, and be kept in a dark place.

Rationale.—The ferrocyanide of potassium is decomposed by the sulphuric acid, the resulting compounds being hydrocyanic acid, which distils over, and acid sulphate of potassium, and Everitt's yellow salt, which remain in the flask or retort. Thus:—

$$2K_4Fe(CN)_6 + 6H_2SO_4 = 6HCN + 6KHSO_4 + \overset{\text{Everitt's Salt.}}{FeK_2Fe(CN)_6}$$

Characters and Tests.—A colourless liquid with a peculiar odour. Specific gravity, 0·997. It only slightly and transiently reddens litmus paper.[1] A fluid drachm of it evaporated in a platinum dish leaves no fixed residue.[2] Treated with a minute quantity of a mixed solution of sulphate and persulphate of iron, afterwards with potash, and finally acidulated with hydrochloric acid, it forms Prussian blue.[3] It gives no precipitate with chloride of barium, but with nitrate of silver it gives a white precipitate, entirely soluble in boiling concentrated nitric acid.[4] 270 grains of it, to which solution of litmus is added, the fluid being rendered alkaline by the addition of solution of soda, and maintained faintly alkaline throughout the operation—which should be performed speedily so as to prevent loss of acid by volatilisation—require 1000 grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, which corresponds to 2 per cent. of the real acid, HCN.[5]

Dose.—2 to 8 minims.

[1] Indicating absence of mineral acids. [2] Absence of fixed impurities. [3] Characteristic of a cyanide. [4] Absence of hydrochloric acid. [5] A soluble double cyanide of silver and sodium, $AgNa(CN)_2$, is formed. As soon as the whole of the HCN has been thus taken up the addition of more $AgNO_3$ produces the insoluble cyanide of silver, AgCN, which renders the liquid opalescent from formation of a permanent precipitate.

Official Preparations.—Vapour Acidi Hydrocyanici (10 or 15 minims), Tinctura Chloroformi et Morphinæ (1 in 16).

VAPOR ACIDI HYDROCYANICI—INHALATION OF HYDROCYANIC ACID.—*Take of diluted hydrocyanic acid*, 10 *to* 15 *minims; water, cold*, 1 *fluid drachm. Mix in a suitable apparatus, and let the vapour that arises be inhaled.*

ACIDUM HYDROCYANICUM (SCHEELE) (*B.P.C.*)—HYDROCYANIC ACID (Scheele)—(*not official*).—*The formula is exactly similar to that for the official diluted hydrocyanic acid except that* 24 *ounces of distilled water is substituted for* 30 *ounces;* 1 *ounce instead of* 8 *ounces of distilled water is placed in the receiver; and distillation is continued till the liquid in the receiver measures* 10 *fluid ounces instead of* 17. *Sufficient water is added to give a product containing* 4 *per cent. instead of* 2 *per cent. by weight of real acid HCN.*

Characters and Tests.—Specific gravity, 0·994. Its strength, as determined by the official process by means of volumetric solution of nitrate of silver, should correspond to 4 per cent. of hydrocyanic acid, HCN. Otherwise it answers to the official characters and tests for diluted hydrocyanic acid.

Dose.—1 to 4 minims.

The preparation has been suggested in place of the variable preparations met with in commerce under the general designation of *Scheele's Prussic Acid*, and which contained about from 3 to 5 per cent. of HCN.

Therapeutics.—Hydrocyanic acid acts as a most powerful and rapid poison. It destroys protoplasmic movement, kills infusoria, checks oxidation, and arrests fermentation. Even smelling a bottle containing a strong sample of the acid might produce dangerous effects, and the vapour of the anhydrous acid would be immediately fatal if respired. So quick is it in its action as a poison, that it is very difficult to record accurately the succession of symptoms which follow an overdose. The following is a collection of symptoms which have been observed in various cases, rather than a necessary result to be observed in any particular case. The poisoning usually begins instantaneously, and when a large dose is taken is seldom protracted beyond a minute or two. There may be heat and constriction of the mouth and fauces, vertigo, tinnitus aurium, faintness, profound insensibility, pupils dilated and insensible to the action of light; more or less of rigidity of the voluntary muscles, or the limbs may be flaccid; pulse weak and fluttering, or imperceptible; skin pallid, cold, and bathed in perspiration; frothing at the mouth; breathing heavy and laboured, with intervals of perfect repose, sometimes stertorous; convulsions are but seldom seen in the human subject, except a dose sufficiently large to kill, and yet not to produce instant death, has been taken. It has been stated that these symptoms are sometimes preceded by a loud shriek, but this has not been established in the human subject, though it has been noted that a characteristic cry is uttered by the lower animals. In small but dangerous doses, the common symptoms are giddiness, faintness, nausea, confusion of intellect, muscular prostration, hurried respiration, and a quick pulse. An odour of hydrocyanic acid may be perceived in the breath and apartment. Although usually exceedingly rapid in its action, there are many cases on record in which persons who have committed suicide by prussic acid have had time to cork the bottle from which the poison had been taken, arrange themselves comfortably in bed, or walk a few paces before the symptoms overcame them. Death generally takes place, when large doses are taken, within from two to ten minutes; and although a few cases are recorded in which death has taken place so long as an hour afterwards, recovery commonly takes place when the patient is kept alive during the first half hour.

Medicinally, hydrocyanic acid acts as a sedative, calmative, anodyne, and antispasmodic, and it is employed chiefly to diminish the force and frequency of the pulse, to calm nervous excitement, to allay irritability, to soothe pain, and to relieve spasm. When applied externally, it passes through the epidermis and paralyses the ends of the sensory nerves below, exercising a topical anæsthetic action, causing numbness and insensibility, more or less, to pain, without affecting the nervous centres. It has been given in hypertrophy of the heart, in nervous palpitation, in angina pectoris, in pericarditis, &c.; to allay the cough of phthisis, and that of nervous and hysterical females; to relieve painful and spasmodic affections of the stomach and bowels, in gastrodynia, enterodynia, visceral neuralgia, in chronic vomiting, in pertussis and spasmodic asthma; in various forms of neuralgia, in rheumatism, and in painful diseases such as cancer; in chorea, epilepsy, tetanus, &c. Externally, it is used, sufficiently diluted, to allay the itching and irritation of certain skin diseases, care being taken to avoid broken surfaces. If applied to an abraded or mucous surface it acts as a powerful poison. The official diluted acid may be given in doses of 1 or 2 minims, cautiously increased up to 6 or 8 minims. Scheele's acid may be given in one half of these proportions; the dose may be repeated at intervals of two or three hours, as the effects quickly pass off, and it is advisable to give it either in plain water or other simple vehicle. When prescribed in the form of mixture, directions should be given to shake the bottle before each dose is taken, because the acid is apt to accumulate in the form of vapour in the empty part of the bottle, and would escape if this precaution were not enjoined. As a lotion, 1 or 2 fluid drachms to 8 ounces of distilled water, with a little glycerine, taking care to avoid broken surfaces in its application.

Antidotes.—It is but seldom that antidotes can be available against a poison so subtle and swift as hydrocyanic acid, when taken in large quantity; nevertheless, all the means at our disposal are to be carefully and perseveringly employed. The indications of treatment are to neutralise the poison, and to sustain the patient's life until its somewhat transient effects have disappeared. As a chemical antidote, give a mixed solution of sulphate of iron and carbonate of potash (or soda or magnesia), which form prussian blue, an inert compound. In addition, stimulants, cold affusion to the head and chest, inhalation of ammonia or liquor chlori, artificial respiration, subcutaneous injection of atropine (2 minims Liq. Atropinæ Sulph., *B.P.*), or 30 minims of tincture of belladonna by the mouth.

Impurities.—Aqueous solutions of HCN, especially if a trace of NH_3 be present, are liable to decomposition with formation of cyanide and formate of ammonium and brownish, humus-like bodies. The addition of a small proportion of a mineral acid tends to prevent this change, and hydrochloric acid, added for this purpose, may be present as an impurity. The most important defect, however, is a departure from the official percentage of HCN, and consequently commercial samples should invariably be carefully estimated before being used medicinally.

AMYGDALA DULCIS—*Sweet Almond.*—The ripe seed of the sweet almond tree, *Prunus Amygdalus*, Stokes, var. *dulcis*, Baillon. Imported from Malaga, and known as the Jordan almond.

Characters.—About an inch or somewhat more in length,[1] nearly oblong in form,[1] more or less compressed, pointed at one end and rounded at the other, and covered by a scurfy cinnamon-brown coat. It has a bland, sweet, nutty taste,[2] and when triturated with water forms a white emulsion of an agreeable taste, but without any marked odour.[2]

[1] Inferior varieties of sweet almonds are much shorter and somewhat ovoid in form. [2] Absence of bitterness and ratafia odour distinguish from bitter almonds.

Of the commercial varieties of sweet almonds the *Jordan almonds* alone are official; the other varieties are *Valencia*, *Sicily*, and *Barbary almonds.* They are much more like bitter almonds in appearance, but may be readily detected by the absence of bitterness and the freedom from odour of their emulsion. Almonds are sometimes imported in the shell or *endocarp,* and are then known as *almonds in the shell. Blanched almonds* consist of the *embryo* alone, from which the outer cinnamon-brown coat or *testa* and the thin inner membrane or *endopleuro* have been removed by maceration in warm water.

Active Principles.—Sweet almonds yield by expression about 50 per cent. of *fixed oil.* They also contain *sugar* and *emulsin*, but differ from bitter almonds in containing no *amygdalin.* The *fixed oil* of sweet almonds differs from that of bitter almonds in absorbing about twice as much bromine as the latter. Most of the commercial *almond oil* is obtained from bitter almonds.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Mistura.	Compound powder.	1 in 8.	1 to 2 fluid ounces.
Oleum.	Ripe seeds.	1 of oil from 2.	...
Pulvis Co.	" "	8 in 13.	

MISTURA AMYGDALÆ—Almond Mixture.—*Take of compound powder of almonds,* 2 *ounces; distilled water,* 16 *ounces. Rub the powder with a little of the water into a thin paste, then add the remainder of the water, and strain through muslin.*

OLEUM AMYGDALÆ—Almond Oil.—(See page 320.)

PULVIS AMYGDALÆ COMPOSITUS—Compound Powder of Almonds (Confectio Amygdalæ, *Lond.;* Conserva Amygdalarum, *Ed.*).—*Take of sweet almonds,* 8 *ounces; refined sugar, in powder,* 4 *ounces; gum acacia, in powder,* 1 *ounce. Steep the almonds in warm* *water until their skins can be easily removed; and when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the gum and the sugar; and adding them to the almond pulp gradually, rub the whole to a coarse powder. Keep it in a lightly-covered jar.*

Therapeutics.—Sweet almonds, when fresh, are nutritive, demulcent, and emollient; in consequence of the oil which they contain they are somewhat indigestible, especially when rancid. The skins or husks of sweet almonds have been known to cause considerable irritation of the alimentary canal, attended with œdema of the face and urticaria; hence they are blanched when used as dessert. Almond mixture is used, either alone or as an elegant vehicle for other remedies of the same class, as a demulcent in irritable and inflammatory conditions of the mucous membranes. Almond oil is employed in the preparation of resin, spermaceti, and simple ointments, and phosphorated oil; and is used externally as an emollient.

Adulterations or Substitutions.—Jordan almonds sometimes contain an admixture of inferior varieties, but a more dangerous adulteration is the presence of the highly poisonous bitter almonds. The official characters serve to detect both adulterations.

Prunus domestica—The St Julien or French Plum Tree.

PRUNUM—*Prune.*—The dried drupe of *Prunus domestica*, Linn., var. *Juliana*, D.C. Imported from the South of France.

Character.—Somewhat ovoid or oblong, about 1¼ inch long, black, shrivelled; pulp (or sarcocarp) brownish, without marked odour, with a sweet and somewhat mucilaginous taste.

Active Principles.—The pulp, in which the virtues of the fruit reside, contains *sugar*, *malic acid*, and *pectic* and *albuminoid substances.* No distinctive principle having laxative properties has been found in it.

Official Preparation.—Confectio Sennæ, 1 in 12½.

Therapeutics.—Prunes are used in pharmacy only in the preparation of confection of senna. They are nutrient, demulcent, and laxative, and are used for a variety of domestic purposes.

Adulteration or Substitution.—When the official or French prune is scarce an inferior variety, obtained from *Prunus œconomica*, Borkhausen, is imported from Germany. It is larger, more elongated, and has a thicker skin than the official prune.

Prunus Laurocerasus—Cherry Laurel—Cherry Bay—Common Laurel.

Botany.—A small tree or evergreen shrub. *Leaves*, short-stalked, 5 to 7 inches long, oblong, coriaceous, shining on the upper surface with a very prominent midrib, with one or two small yellow glands on either side beneath. *Flowers*, in axillary racemes, white. *Drupes*, about the size of a small cherry, round, black, without bloom. Common in gardens and shrubberies through Europe.

LAUROCERASI FOLIA—*Cherry Laurel Leaves.*—The fresh leaves of *Prunus Laurocerasus*, Linn.

Characters.—Thick, coriaceous, on strong, short petioles, oblong, or somewhat obovate, 5 to 7 inches long, tapering towards each end recurved at the apex, distantly but sharply serrated, and slightly revolute at the margins, dark-green, smooth, and shining above, much paler beneath, and with a prominent midrib, on either side of which, towards the base, are one or two glandular depressions. Inodorous, except on bruising, when they emit a ratafia-like odour.

Active Principles.—The leaves appear to contain a ferment similar to *emulsin*, and a glucoside similar to *amygdalin*, so that when bruised and mixed with water a *volatile oil*, identical with the oil of bitter almonds and *hydrocyanic acid*, are produced. The name *laurocerasin*, $C_{40}H_{67}NO_3$, has been applied to this glucoside, but the real explanation of the production of *volatile oil* and *hydrocyanic acid* from the leaves has not been conclusively determined. Winckler has shown that the *volatile oil* probably exists to some extent ready formed in the leaf, and Bonenkamp and Elk have shown that the unbruised leaves, when distilled with water, give a higher yield of *hydrocyanic acid* than the bruised leaves under the same conditions. Young leaves gathered in July and August give the highest yield of *hydrocyanic acid.*

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Aqua.	Fresh leaves.	0·1 per cent. HCN.	½ to 2 fluid drachms.

AQUA LAUROCERASI—LAUREL WATER.—*Take of fresh leaves of common laurel,* 1 *pound; water,* 2½ *pints. Chop the leaves, crush them in a mortar, introduce them with the water into a retort, and distil* 1 *pint of liquid. Shake the product, filter through paper, and adjust the strength of the finished product either by addition of hydrocyanic acid or by diluting the distillate with distilled water, so that* 810 *grains of it, tested as described in the process for diluted hydrocyanic acid, shall re-*

quire 150 *grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, which corresponds to* 0·1 *per cent. of real hydrocyanic acid.*

Therapeutics.—Cherry-laurel water acts in the same way as *hydrocyanic acid,* which is its real active constituent. The grateful odour of the *volatile oil* renders it an agreeable and elegant mode of administering the acid, which, when alone, has an odour somewhat repulsive and nauseating. Owing to the uncertain strength of the water, formerly official, it had to a large extent ceased to be employed for internal use, but now that a definite standard has been fixed, this objection is removed. It is frequently employed externally in the form of a lotion in the same cases as *hydrocyanic acid.*

Hagenia abyssinica—Bryera.—The Kousso, Cusso, Koso, or Habbe Tree.

Cusso—*Kousso.*—The dried panicles (chiefly of the female flowers) of *Hagenia abyssinica,* Willd.

Characters.—In compressed clusters or more or less cylindrical rolls, usually 10 inches or more in length, or the panicles are broken up into small fragments ; brownish or greenish-brown, or reddish in the case of the female flowers (*red Kousso*) ; odour herby, tea-like ; taste bitter acrid and disagreeable. The separate panicles are much branched, zigzag, more or less covered with hairs and glands, and with a large sheathing bract at the base of each branch. Flowers numerous, small, shortly stalked, unisexual, with two roundish, membranous veiny bracts at the base of each flower, which are brownish-yellow in the male (*Kosso-esels*), and tinged with red in the female flowers ; calyx hairy externally, veiny, with ten segments in two alternating whorls.

Dose.—$\frac{1}{4}$ to $\frac{1}{2}$ ounce.

Active Principles.—Kousso contains *volatile oil, bitter acrid resin, tannic acid,* and about 3 per cent. of *Koussin* or *Kosin,* $C_{31}H_{38}O_{10}$, a bitter, acrid, yellowish-white, indistinctly crystalline substance, to which the anthelmintic properties of the drug have been attributed, though this point has not been made absolutely clear.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Infusum.	Dried panicles.	$\frac{1}{4}$ ounce to 4 fluid ounces.	4 to 8 fluid ounces.

INFUSUM CUSSO—INFUSION OF KOUSSO.—*Take of kousso, in coarse powder,* ½ *ounce; boiling distilled water,* 8 *fluid ounces. Infuse in a covered vessel for fifteen minutes, without straining.*

Therapeutics.—Kousso acts as an anthelmintic, and is effectual in both kinds of tapeworm, namely *Tænia solium* and *Bothriocephalus latus.* It operates, probably, by a toxic or poisonous effect upon the worm, and not by a mere mechanical or purgative influence; it is therefore properly regarded as a *vermicide.* It does not usually produce any marked physiological effects; but may be followed by nausea or vomiting, thirst, and a very slight action upon the bowels. It usually requires to be followed by a purge, and its disagreeable taste is best concealed by a little lemon juice. *Koussin* or *Kosin,* in doses of 20 grains, is said to act as well as the infusion, and has not the disadvantage of producing nausea and vomiting.

Adulterations.—The high price of the drug subjects it to adulteration in the powdered state. It should therefore be purchased unpowdered, in which state its botanical characters are a sufficient test of genuineness.

Rosa Canina—Common Wild Rose—Dog Rose.

Botany.—A variable species, with varieties having distinct names. *Shoots,* arched or erect, with uniform hooked prickles. *Leaves,* glandless, naked, or slightly hairy. *Flowers,* usually pale pink coloured. *Fruit,* scarlet or crimson, ovoid, succulent, with a sweetish acidulous pulp.

ROSÆ CANINÆ FRUCTUS—*Fruit of the Dog Rose—Hips.*—The ripe fruit of *Rosa canina,* Linn., and other indigenous allied species.

Characters.—About ¾ of an inch in length, ovoid or somewhat oval, smooth, shining, scarlet or red; inodorous; taste pleasant, sweetish, acidulous.

Active Principles.—The pulp of the fruit contains 3 per cent. free *citric acid,* 8 per cent. free *malic acid,* 25 per cent. *gum,* 30 per cent. *uncrystallisable sugar,* and *citrates* and *malates* of the alkalis and alkaline earths.

Official Preparation.

Name.	Part Used.	Strength.
Confectio.	Hips without seeds.	1 in 3.

CONFECTIO ROSÆ CANINÆ—CONFECTION OF HIPS.—*Take of hips, deprived of their seeds,* 1 *pound; refined sugar,* 2 *pounds. Beat* *the hips to a pulp in a stone mortar, and rub the pulp through a sieve; then add the sugar, and rub them well together.*

Therapeutics.—The pulp is slightly refrigerant and astringent. The confection forms a convenient and pleasant pill basis for insoluble or disagreeable tasting powders, or for the making of linctuses and electuaries.

Rosa Centifolia—Cabbage Rose—Hundred-leaved Rose—Moss Rose, &c.

Botany.—A bushy shrub. *Shoots*, erect, rather thickly covered with nearly straight prickles, intermixed with glandular hairs. *Leaflets*, five to seven, oblong or ovate, glandular at the margin, hairy beneath. *Flowers*, several together, mostly very double, drooping. *Petals*, large, thin, rose-pink or white. *Fruit*, oblong or ovoid-oblong, orange-red when ripe.

ROSÆ CENTIFOLIÆ PETALA—*Cabbage-Rose Petals.*—The fresh fully expanded petals of *Rosa centifolia*, Linn. From plants cultivated in Britain.

Characters.—Large, thin, delicate, very fragrant, and with a sweetish, slightly astringent, bitterish taste. Both odour and taste are readily imparted to water.

The petals are most fragrant when the flowers are full blown. By drying they become brown and less fragrant, but they may be preserved for some time by mixing them with common salt, pressing the mixture into a closely-stopped vessel, and keeping in a cool place.

Active Principles.—Cabbage-Rose petals contain the same substances as those of *Rosa gallica*. By distillation with water they yield a little *volatile oil*, which is the essential constituent of the official rose water. This volatile oil is a butyraceous substance, of weak rose-like but not very agreeable odour. It differs very much from the *oleum rosæ* or *otto of roses* of commerce, and appears to consist mainly of an inodorous solid *hydrocarbon* or *stearopten*, and a small proportion of an odorous *liquid oxygenated hydrocarbon*.

Official Preparation.

Name.	Part Used.	Strength.
Aqua.	Fresh or salted petals.	10 lbs. yield 1 gallon.

AQUA ROSÆ—ROSE WATER.—*Take of fresh petals of the hun-*

dred-leaved rose (or an equivalent quantity of the petals preserved while fresh with common salt), 10 *pounds; water* 5 *gallons. Distil* 1 *gallon.*

Rose water is frequently prepared by distilling otto of roses with water, or by rubbing up the otto with a little carbonate of magnesium or talc, gradually adding the water and filtering.

OLEUM ROSÆ—*Oil of Roses—Attar or Otto of Rose—(not official).*—A volatile oil obtained from the flowers of *Rosa damascena*, Miller, by distillation with water.

Characters.—Imported principally from Turkey. *Otto of rose* is a bright oily liquid, of a pale yellow colour, and with a specific gravity of 0·87 to 0·89. It possesses a very powerful and diffusive odour of roses and consists of a solid inodorous *stearopten*, $C_{16}H_{34}$, and a highly odorous *oxygenated liquid hydrocarbon.* Owing to the presence of the former, the oil congeals at temperatures of from 10° to 15° C., different samples varying in the congealing point according to the proportions of *stearopten*, which ranges from 18 to 50 per cent. About 100 pounds of rose petals are required to yield about 3 fluid drachms of otto. It is therefore very expensive and hence is systematically adulterated. The usual adulterants are *sandal-wood oil*, which may be detected by the odour and by leaving a permanent greasy stain on paper; so-called *oil of geranium* obtained from *Andropagon pachnodes*, detected by not congealing when exposed to a low temperature; and *spermaceti* which is added to raise the congealing point, and may be detected by being left behind when a little of the sample is exposed in a watch-glass to the heat of a water-bath.

Therapeutics.—Rose water is used chiefly, on account of its fragrance, in the preparation of lotions and collyria. It is an ingredient of *Mistura Ferri Composita*, and of *Trochisci Bismuthi.* Otto of rose is used medicinally for scenting ointments and cerates, in certain spirituous preparations for internal use, and in the preparation of rose water. Its chief uses are in perfumery and for scenting snuff.

Rosa gallica—French Rose—Provins Rose—Red Rose.

Botany.—A small erect shrub. *Shoots*, armed with nearly equal uniform prickles and glandular bristles intermixed. *Leaflets*, stiff, elliptical, rugose, without glands at the margin. *Flowers*, several together, large, erect, with leafy bracts. *Petals* 5, spreading, dark rich pink. *Fruit*, globose or ovoid, smooth, scarlet, and crowned with the persistent calyx-segments.

ROSÆ GALLICÆ PETALA—*Red Rose Petals.*—The fresh and dried unexpanded petals of *Rosa gallica*, Linn. From plants cultivated in Britain.

Characters.—Usually in little cone-like masses, or sometimes separate and more or less crumpled; fine purplish-red, retained after drying, velvety; odour fragrant, roseate, especially developed by drying; taste bitterish, feebly acid and astringent.

Active Principles.—Red-rose petals contain a *volatile oil*, an acid red *colouring matter*, *glucose*, *quercitannic acid*, *quercitrin*, and traces of *tannin*, and *gallic acid*. The astringency is due to the glucoside *quercitrin* and not to *tannin*, as was formerly supposed, and it is the presence of the former in the infusion that produces the dark greenish precipitate with ferric salts. Boiling water extracts the properties of the petals, giving a pale red infusion, which is changed to a brilliant crimson on the addition of acids, and to a bright green by alkalis.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Confectio.	Fresh petals.	1 in 4.	...
Infusum.	Dried petals.	1 in 40.	1 to 2 fl. ozs.
Syrupus.	" "	1 in $17\frac{1}{2}$.	1 fl. drachm.

CONFECTIO ROSÆ GALLICÆ—CONFECTION OF ROSES.—*Take of fresh red-rose petals, 1 pound; refined sugar, 3 pounds. Beat the petals to a pulp in a stone mortar, add the sugar, and rub them well together.*

INFUSUM ROSÆ ACIDUM—ACID INFUSION OF ROSES.—*Take of dried red-rose petals, broken up, ¼ ounce; diluted sulphuric acid, 1 fluid drachm; boiling distilled water, 10 fluid ounces. Add the acid to the water, infuse the petals in the mixture in a covered vessel for half-an-hour, and strain.*

An infusion made with cold water by maceration and percolation is less apt to deposit on standing than the official infusion. A cold infusion is also made with nitric instead of sulphuric acid, and with the addition of 1 in 40 of sugar, as a vehicle for quinine draughts.

SYRUPUS ROSÆ GALLICÆ—SYRUP OF ROSES.—*Take of dried red-rose petals, 2 ounces; refined sugar, 30 ounces; boiling distilled water, 1 pint. Infuse the petals in the water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter.*[1] *Dissolve the sugar in the liquor by means of heat. The product should weigh 2 pounds 14 ounces, and should have the specific gravity about* 1·335.

[1] To coagulate and remove albuminoids which would induce fermentation in the syrup.

Therapeutics.—The preparations of the red-rose petals are chiefly used to give colour and flavour, and to perform the part of vehicles to other medicines. They are somewhat astringent, and the infusion forms an agreeable refrigerant and astringent gargle, but it is to be noted that borax and alkalis change the colour to green. The confection is principally used as a pill basis, and is also applied to aphthous conditions of the mouth as a linctus.

Prunus serotina—Prunus Virginiana—Wild Black Cherry Tree —(*not official*)—*Habitat.*—North America.

PRUNI VIRGINIANÆ CORTEX—*Wild-Cherry Bark.*—The bark of *Prunus serotina*, Erhart (*Prunus Virginiana*, Mill), collected in autumn.

Characters.—In curved pieces or irregular fragments, $\frac{1}{12}$ of an inch or more thick, outer surface greenish-brown or yellowish-brown, smooth and somewhat glossy, marked with transverse scars; if collected from old wood and deprived of corky layer, the outer surface is rust brown and uneven ; inner surface somewhat striate and fissured. Upon maceration in water it develops a distinct bitter-almond odour ; its taste is astringent, aromatic, and bitter. The bark of the small branches is to be rejected.

Active Principles.—Wild-cherry bark, when bruised and macerated with water, yields about 0·21 per cent. of a *volatile oil*, identical with the volatile oil of bitter almonds, and, like it, containing a considerable proportion of *hydrocyanic acid*, which is the real medicinal active principle. The *volatile oil* or *benzaldehyde* and hydrocyanic acid do not exist ready formed, but are produced by the hydrolysis of a glucoside, differing from *amygdalin* in being non-crystallisable, and more closely resembling the *laurocerasin* of cherry-laurel. The hydrolysis is effected by a *ferment principle* analagous to but apparently not identical with the *emulsin* of bitter almonds. The bark also contains a crystalline *fluorescent glucoside*, resembling *æsculin*, to which its bitterness appears to be due, and *tannin* and *gallic acid.*

EXTRACTUM PRUNI VIRGINIANÆ FLUID (*U.S.P.*)—FLUID EXTRACT OF WILD CHERRY—(*not official*).—*Made with diluted alcohol, glycerine, and water, so that* 1 *fluid ounce represents* 1 *ounce of the bark.*

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

INFUSUM PRUNI VIRGINIANÆ (*U.S.P.*)—INFUSION OF WILD CHERRY—(*not official*).—*Take of wild-cherry bark, in No.* 40 *powder,* $\frac{1}{2}$ *ounce; distilled water, sufficient to make* 12 *fluid ounces.*[1] *Moisten the powder with* 6 *fluid ounces of water, and allow to marcerate* 1 *hour.*

Then pack in a percolator, and pour water upon it until the percolate measures 12 *fluid ounces.*

Cold water is ordered because boiling water would destroy the ferment, and warm water would cause loss of the *volatile oil* and *hydrocyanic acid.*

Dose.—2 to 3 fluid ounces.

SYRUPUS PRUNI VIRGINIANÆ (*U.S.P.*)—SYRUP OF WILD CHERRY—(*not official*).—*Take of wild-cherry bark, in No.* 20 *powder,* 5½ *ounces; sugar, in coarse powder,* 28 *ounces; glycerine,* 2 *fluid ounces;*[1] *water, a sufficiency. Moisten the wild-cherry bark thoroughly with water, and allow to macerate for* 24 *hours. Then pack in a percolator, and gradually pour water upon it until the percolate measures* 15 *fluid ounces. Dissolve the sugar in the liquid by agitation, without heat, add the glycerine, and strain.*

Dose.—1 to 4 fluid drachms.

[1] The quantity of glycerine should be increased to effect better preservation.

TINCTURA PRUNI VIRGINIANÆ (*B.P.C.*)—TINCTURE OF WILD CHERRY—(*not official*).—*Take of wild-cherry bark, in No.* 20 *powder,* 4 *ounces; distilled water,* 7½ *fluid ounces. Macerate for* 24 *hours in a closed vessel, and add rectified spirit,* 12½ *fluid ounces. Macerate for* 7 *days; then press, filter, and add proof spirit sufficient to produce* 1 *pint.*

Dose.—20 to 60 minims.

PRUNIN or CERASIN—(*not official*).—An eclectic remedy prepared by evaporating the tincture and powdering the extract.

Dose.—1 to 5 grains.

Therapeutics.—Wild-cherry bark possesses a tonic power along with the property of calming irritation and diminishing nervous excitability; it is admirably adapted to the treatment of diseases in which debility of the stomach or of the system is united with general or local irritation. When largely taken, it diminishes the action of the heart—an effect ascribable to the hydrocyanic acid. It has been much employed in the hectic fever of scrofula and consumption, and to palliate the cough in phthisis and bronchitis. It is also a valuable remedial agent in the treatment of functional and organic disease of the heart, when attended with a frequent irregular and rather feeble pulse, and an anæmic or otherwise debilitated state of the system.

Quillaya saponaria—Soap Bark Tree—(*not official*)—*Habitat.*—Peru and Chili.

CORTEX QUILLAYÆ—*Quillaya* or *Quillaja*, or *Soap Bark.*—The inner bark of *Quillaya saponaria*, Molina.

Characters.—Flat, large pieces, about one-fifth of an inch thick;

outer surface brownish-white, often with small patches of brown cork attached, otherwise smooth ; inner surface whitish, smooth ; fracture splintery, checkered with pale-brownish bast fibres, imbedded in white tissue ; inodorous, very acid and sternutatory, and containing numerous crystals of calcium oxalate.

Active Principles.—When bruised and macerated in water quillaya bark forms a lather like soap when the liquid is agitated. This is due to the amorphous glucoside *saponin*, $C_{32}H_{54}O_{18}$ (?), of which it contains about 8·5 per cent. *Saponin*, when boiled with dilute acid, splits up into *sapogenin*, $C_{14}H_{22}O_2$, and *glucose*. Kobert has shown that commercial *saponin* is mostly an inert modification of *quillayic* or *quillajic acid*, $C_{19}H_{30}O_2$, which he obtained in white crystalline flakes from an aqueous extract of quillaya bark. It is an acid glucoside, and yields *sapogenin* and *glucose* when boiled with dilute acids. The bark also contains *sapotoxin*, a neutral glucoside. *Quillajic acid* closely resembles the *polygalic acid*, and *sapotoxin* closely resembles the *senegin* of Senega root ; but physiologically, *sapotoxin* is ten times more active than *senegin*.

DECOCTUM QUILLAYÆ (Kobert)—Decoction of Quillaya —(*not official*).—*Quillaya, in chips,* ¼ *ounce; distilled water,* 10 *fluid ounces. Boil for* 15 *minutes, and strain.*

Dose.—1 to 4 fluid drachms.

EXTRACTUM QUILLAJÆ FLUIDUM (*A.N.F.*)—Fluid Extract of Quillaja—(*not official*).—*Quillaya bark, in No.* 40 *powder, exhausted with diluted alcohol and evaporated, so that* 1 *fluid ounce represents* 1 *ounce of bark.*

Dose.—5 to 15 minims.

TINCTURA QUILLAYÆ — Tincture of Quillaya — (*not official*).—*Quillaya bark, in No.* 20 *powder,* 1 *ounce; proof spirit sufficient to make* 5 *fluid ounces. Made by maceration and percolation.*

Dose.—½ to 1 fluid drachm.

Therapeutics.—Quillaya bark has been strongly recommended by Kobert as a substitute for senega. It has been found of use in emphysema, dilatation of the bronchi, chronic bronchial catarrh, and pneumonia, and in fact wherever expectoration is difficult, and the mucus thick, tenacious, adhesive, and gluey. It is contra-indicated in inflammation of the intestines or stomach, or ulcerated conditions of the mucous membrane. The powdered bark, when snuffed, provokes sneezing, and has been used for catarrhal rhinitis. Quillaya has been suggested as a remedy in aortic disease with hypertrophy, and as a substitute for sarsaparilla. The tincture is used to emulsify coal-tar, fixed and volatile oils, and resins. It is also frequently added to various beverages to give them a "head." The decoction is employed as a detergent hair-wash, and the powder is employed for making a saponaceous tooth-powder. An infusion is extensively employed in cleansing silks, cloths, and other fibrics, for which soap would not be suitable. *Quillajic acid* and *Sapotoxin* closely agree in physiological action, and act as powerful irritants, local anæsthetics, and muscular poisons. They are powerful sternutatotaries, and when taken internally, cause vomiting, diarrhœa, and gastro-enteritis. They counteract the effect of digitalis on the heart.

Agrimonia Eupatoria—Common Agrimony—(*not official*)—*Habitat.*—Indigenous.

Botany.—A perennial herb, found in fields and on the borders of woods. *Stem*, 1 to 3 feet, hairy, *leaves* interruptedly pinnate; *flowers* yellow, in a long simple spike. The herb and root are mildly corroborant and astringent, and have been employed in relaxed conditions of disease, as in passive hæmorrhages and chronic affections of the mucous membranes. It has been recommended also as a deobstruent in jaundice and visceral obstructions, as an alterative in skin diseases, and as a vermifuge. It is popularly employed, in the form of a gargle, in affections of the throat.

Dose.—Of the powder 1 drachm.

Potentilla Tormentilla—Tormentil—(*not official*)—*Habitat.*—Indigenous.

Botany.—A small perennial herb, growing on barren pastures, heaths, and bushy places. *Root*, large, irregularly tuberous-shaped. *Stem*, weak, slender, often procumbent, much branched. *Leaves*, dark green, somewhat hirsute. *Flowers*, bright yellow. The rhizome was formerly official; it is of irregular shape, and of great size, as compared with the entire plant; it is sometimes nearly cylindrical, but often knotty and tuberculated, dark brown externally, flesh-red internally, has a strong astringent taste, but little odour. Tormentil acts as an astringent and tonic, and is used in chronic diarrhœa and dysentery, and in passive hemorrhages; as an injection in mucous discharges, and as an astringent wash to indolent sores.

Dose.—Of the powdered root 30 to 60 grains.

Decoctum Tormentillæ (*L.P.*) contains 2 ounces of bruised tormentil to $1\frac{1}{2}$ pints of water, boiled bown to 1 pint.

Dose.—1 or 2 fluid ounces; used also as a lotion and injection.

Geum urbanum—Common avens—(*not official*).—Has properties similar to those of tormentil, and has been used in similar cases. It is indigenous, growing in shady places, woods, and hedgerows.

Pyrus Cydonia—*Cydonia vulgaris*—Common Quince—(*not official*).—Cultivated in South of England. Seeds imported from the South of France, the Cape of Good Hope, and Hamburg.

Botany.—The seeds of the Common Quince were formerly official. This tree is small, usually crooked, and much branched, with ovate, obtuse leaves, and large, solitary, pale rose-coloured flowers, few in number. The fruit is a closed, globose or oblong pome, yellow and austere, but with an agreeable odour; it is five-celled, each cell containing many seeds, enveloped in a condensed mucilage.

SEMEN CYDONIÆ—*Quince Seeds.*—The seeds are of a reddish-brown colour, flat on one side, convex on the other, and ovate-acute. They are covered with a coat of fine cellular structure, in which is much mucilage; when immersed in water, the mucilage swells, distends, and bursts the cells. They are odourless when unbroken, but when bruised and rubbed up with water acquire a bitter-almond odour, from formation of volatile oil and hydrocyanic acid. The fruit, when stewed or otherwise cooked, is eaten, but is not fit for food in the raw state; it is made into marmalade, or is used to flavour other fruits. Quince seeds are used medicinally only for the sake of their *mucilage*, which Dr Pereira, considering it to be peculiar, called *Cydonin*. Flückiger and Hanbury regarded it as a soluble modification of *cellulose*. The mucilage is abstracted by boiling water, and therefore a decoction has demulcent and emollient properties. The *Decoctum Cydoniæ* of the *L.P.* was made with 120 grains of the seeds, boiled for 10 minutes in a pint of distilled water, and strained. Its properties are similar to those of linseed tea; it does not keep well. It is employed as a demulcent application in skin diseases, affections of the eye, erysipelas, &c. The seeds are used in India as a demulcent tonic and restorative, and in Europe as a remedy in dysentery. The mucilage is used by hairdressers, under the name of *bandoline*, for dressing the hair.

Nat. Ord. **HAMAMELIDACEÆ**—The Witch Hazel.

Order.—Small trees or shrubs; natives of North America, Asia, and Africa. The plants of this order are chiefly remarkable for their fragrant balsamic properties. Some have acid bitter barks; and the leaves and bark of others are astringent.

Official Plants.

Botanical Name.	Part Used.	Habitat.
HAMAMELIS VIRGINICA.	Dried bark and leaves.	United States.
LIQUIDAMBAR ORIENTALIS.	Balsam.	Asia Minor.

Hamamelis virginica—The Witch Hazel—Winter Bloom.

HAMAMELIDIS CORTEX—*Hamamelis* or *Witch Hazel Bark.*—The dried bark of *Hamamelis virginica*, Linn.

Characters.—In quills or slightly curved pieces from 2 to 6 or 8 inches long, and about $\frac{1}{10}$th of an inch in thickness, covered with a silvery-grey or whitish easily detached scaly outer bark, marked with lenticels. Internally, cinnamon-brown or brownish-red, and finely striated longitudinally ; transverse fracture coarsely fibrous ; tough, taste slightly astringent ; no strongly marked odour.

HAMAMELIDIS FOLIA—*Hamamelis* or *Witch Hazel Leaves.*—The dried leaves of *Hamamelis virginica*, Linn.

Characters.—Shortly petiolate, from 4 to 6 inches long, oval, obtuse, wavy crenate, narrowed below, oblique, and slightly heart-shaped at base, pinnately veined, veins prominent on the under surface, nearly smooth. The leaves have a slight tea-like odour and an astringent and bitter taste.

Active Principles.—The root and leaves contain *tannin* and a small quantity of a *volatile oil.* No alkaloid or toxic principle has been found in them.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum Liquidum.	Dried leaves.	1 in 1.	2 to 5 minims.
Tinctura.	Dried bark.	1 in 10.	5 to 60 minims.
Unguentum.	Liquid Extract.	1 in 10.	...

EXTRACTUM HAMAMELIDIS LIQUIDUM—LIQUID EXTRACT OF HAMAMELIS.—*Take of hamamelis leaves, in No.* 40 *powder,* 20 *ounces; rectified spirit and distilled water, of each a sufficiency. Moisten the powder with about* 8 *fluid ounces of a mixture of* 1 *volume of rectified spirit and* 2 *volumes of distilled water. Pack the damp powder in a percolator, and pour on sufficient menstruum to saturate it thoroughly. When the liquid begins to drop, close the lower orifice of the percolator, and macerate for* 48 *hours; then allow percolation to proceed, gradually adding menstruum until the hamamelis is exhausted. Reserve the first* 17 *fluid ounces of the percolate; evaporate or distil off the spirit from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion and add enough menstruum to make the liquid extract measure one pint.*

This process and the next are adopted from the *B.P.C.* Formulary. It is practically the same process as that for liquid extract of cocoa (see page 235), with slight improvements.

TINCTURA HAMAMELIDIS—TINCTURE OF HAMAMELIS.—*Take of hamamelis bark, in No. 20 powder, 2 ounces; proof spirit, a sufficiency. Moisten the powder with a sufficient quantity of the menstruum, and macerate for 24 hours; pack in a percolator, and gradually add proof spirit until one pint of tincture is obtained.*

This is a slight modification of the ordinary official process of maceration and percolation (*see* Tincture of Aconite, page 162).

UNGUENTUM HAMAMELIDIS—OINTMENT OF HAMAMELIS—*Take of liquid extract of hamamelis,* 50 *minims; simple ointment,* 410 *grains. Mix them thoroughly.*

Therapeutics.—Hamamelis is apparently non-poisonous, and, even in large doses, produces no apparent effect on the animal organism. Its medicinal properties have been attributed to the tannin it contains, but this cannot be true of preparations known as *hazeline* and *Pond's extract*, which are said to be equally active, though they are prepared by distillation of the bark with weak alcohol, and therefore contain only volatile constituents. The preparations are applied on lint or cotton wool, or as a lotion or ointment, and are used locally as styptics in all kinds of passive hæmorrhages. A lotion of 1 or 2 drachms of the tincture to 1 ounce of water is applied to bruises and small wounds. Internally it is given for varicose veins and in hæmorrhages, as in epistaxis, hæmoptysis, menorrhagia, &c. Locally applied, and given by the stomach, it is said to be especially valuable in bleeding piles.

Liquidambar orientalis—The Storax Tree.

STYRAX PREPARATUS—*Prepared Storax.*—A balsam prepared from the inner bark of *Liquidambar orientalis*, Miller. Purified by solution in spirit filtration and evaporation. Liquid storax is frequently purified by heating till the water has evaporated, and then straining, thus acquiring a dark brown colour and losing partly its odour.

Characters and Tests.—A semi-transparent, brownish-yellow semifluid balsam, about the consistence of thick honey, with a strong agreeable odour and balsamic taste. Heated in a test-tube on the vapour-bath, it becomes more liquid, but gives off no moisture ;[1] boiled with a solution of bichromate of potassium, and sulphuric acid, it evolves an odour resembling that of essential oil of bitter almonds.[2]

[1] Indicating absence of water. [2] Due to oxidation of cinnamyl compounds.

Active Principles.—Crude liquid storax contains from 10 to 20 per cent. of water, and from 13 to 18 per cent. of solid impurities, consisting chiefly of fragments of bark and also of sand, ashes, &c. The purified article varies in composition, but consists chiefly of cinnamic ethers of *Storesin*, $C_{36}H_{55}(OH)_3$, an amorphous substance, and another isomeric body ; *Styracin* or *Cinnamate of Cinnamyl* or *Styryl*, C_9H_9, $C_9H_7O_2$, which forms prismatic crystals ; *cinnamic acid*, $H.C_9H_7O_2$; a liquid hydrocarbon, *cinnamene* or *styrene*, C_8H_8 ; and a *volatile oil*, $C_{10}H_{16}O$ (?). Liquid storax is one of the best natural sources of cinnamic acid, yielding sometimes as much as 23 per cent.

Official Preparation.—Tinctura Benzoini Co., 33 grs. to ℥i.

Therapeutics.—Similar to Balsam of Peru.

Adulteration.—The drug is sometimes adulterated with sand, ashes, and similar impurities, which may be detected by solution in spirit, or by the microscope. A variety of storax known as *Styrax Calamita*, consists of the coarsely powdered liquid ambar bark (Cortex Thymiamatis) from which the balsam has been pressed, made into cylindrical cakes, with a little liquid storax. It is used as incense.

Nat. Ord. **MYRTACEÆ**—The Myrtle Order.—Trees or shrubs inhabiting tropical and subtropical regions. Their medicinal properties are due to a pungent volatile oil ; some of the plants possess astringent properties, and some yield gummy and saccharine matter.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Eucalyptus amygdalina.	Volatile Oil.	Australia.
Eucalyptus Globulus.	Volatile Oil.	
Eucalyptus rostrata.	Gummy exudation.	"
Eugenia Caryophyllata.	Flower buds.	Zanzibar and Pemba.
Melaleuca minor.	Volatile oil.	Batavia and Singapore.
Pimenta officinalis.	Dried unripe fruits.	West Indies.
Punica Granatum.	Dried root bark.	Mediterranean Shores and Central Asia.

Eucalyptus globulus.
Eucalyptus amygdalina. } The Blue Gum Tree.

OLEUM EUCALYPTI—*Oil of Eucalyptus—Oil of the Gum Tree.*—The oil distilled from the fresh leaves of *Eucalyptus globulus*, Labill—*E. amygdalina*, Labill—(*E. dumosa—E. oleosa*), and probably others.

Characters.—Colourless or pale-straw coloured, becoming darker[1] and thicker by exposure. Odour, aromatic ; flavour spicy and pungent,[2] leaving a sensation of warmth (or coldness) in the mouth. Neutral to litmus paper. Specific gravity about 0·9000.[3] Soluble in an equal weight of alcohol.[4]

[1] As all essential oils. [2] Due to eucalyptol. [3] Should be between 0·910 and 0·930. [4] Absence of turpentine.

Dose.—1 to 4 minims.

Active Principles.—Oil of Eucalyptus consists chiefly of (1) an oxidised portion named *Eucalyptol*, $C_{10}H_{18}O$, a colourless, optically inactive liquid, having a camphor-like smell ; specific gravity 0·923 ; boiling point 176°C ; said to be identical with *Cineol*, and isomeric with *Borneol.* It may be obtained by freezing the oil when it is deposited in crystals, or by distilling between 170° and 190° C, and submitting the fractions to a temperature of at least 16°C for one hour, stirring frequently, and washing the crystals with a small quantity of petroleum ether. The crystals melt above -5°C. (2) Three isomeric terenes, *limonene*, *pinene*, and *phellandrene*, having the formula $C_{10}H_{16}$. Genuine eucalyptus oil should contain 40 to 50 per cent of crystallizable *eucalyptol*, and should yield on distillation 80 per cent of a fraction boiling between 170° and 190° C. The oil should be free from *aldehydes* or *ketones* which irritate the mucous membrane and cause coughing when inhaled. A form of kino is sometimes prepared from the leaves.

Official Preparation.

Name.	Part Used.	Strength.
Unguentum.	Oil.	1 in 5.

UNGUENTUM EUCALYPTI—OINTMENT OF EUCALYPTUS.—*Take of oil of eucalyptus, by weight,* 1 *part ; soft and hard paraffin, of each,* 2 *parts. Melt the paraffins together, add the oil, and stir until cold.*

EUCALYPTUS GAUZE—(*not official*).—*Made from unbleached gauze brushed over with the following mixture :—oil of eucalyptus,* 1 ;

dammar resin, 2; *paraffin wax*, 3. *This is used as an antiseptic surgical dressing.*

TINCTURA EUCALYPTI FOLIORUM, B.P.C.—(*not official*). —*Leaves, one part with rectified spirit to make* 5.

Dose.—15 to 120 minims.

PESSARIES OF EUCALYPTUS.—*Made with white wax and Cacao butter, and containing half a fluid drachm of the oil have also been used.*

Therapeutics.—The contact action is soothing to the sensory nerves when used in dilute solution. It is poisonous to low organism like the other essential oils. In small doses it increases blood tension and pulse rate. In poisonous doses it lowers the blood-pressure and enfeebles the heart. It acts as a paralyser of the spinal cord. It is eliminated by the lungs, kidney, and bowel, and gives a violet-like odour to the urine (like turpentine and similar bodies). Uses :— Externally as an antiseptic dressing in the form of ointment or gauze, although in sensitive individuals it causes a good deal of irritation. Internally : It has been used hypodermically in the form of a solution of the oil in olive-oil in pyæmia. The oil has been given in malaria with doubtful results. In influenza it has been used internally as well as by inhalation; and in a late epidemic the Government offices were sprinkled with it, and it was thought to have some specific prophylactic effect. This is not so : it only acts like any other volatile antiseptic substance. In bronchitis, winter cough, and in phthisical conditions, it plays an important part, whether given by mouth in the form of emulsion or by inhalation, for it acts as a soothing agent to irritated membranes, and as it dries up secretions it is most successful where the expectoration is very abundant. In bladder and genito-urinary troubles dependent on organisms, it may be found useful on account of its antiseptic properties. The resin contained in the leaves is said to be active as an antiseptic. The dose of the oil is 1 to 4 minims. Best given in emulsion form or on lump-sugar.

Adulterations.—The demand for this oil has led to its adulteration with various bodies, among which may be named the following :— Alcohol detected by its dissolving powdered Fuchsin. Fixed oils which alter the specific gravity (about 0·900), and when boiled with water the adulterant floats on the top, or by putting a drop on blue paper and heating, when a stain is left if fixed oil be present. Oil of Turpentine is detected by the alteration on the boiling-point (170° C.), and the terebinthinate odour when rubbed on the hand. Other inferior oils of the *Eucalyptus species* are usually known by the turpentine-like odour which they possess.

Eucalyptus rostrata—The Red Gum Tree.

EUCALYPTI GUMMI—*Eucalyptus Gum*—Red Gum.—A ruby coloured exudation from the bark of *Eucalyptus rostrata*, Schlechtendal, and some other species. Imported from Australia.

Characters and Tests.—From 80 to 90 per cent. of it is soluble in cold water, and forms a neutral solution.[1] Almost entirely soluble in rectified spirit.[2]

Dose.—2 to 10 grains.

[1] These distinguish it from Australian kino, the product of *E. resinifera*, which is not so soluble, and reddens litmus.

[2] This shows absence of sand, earthy matters, pieces of twig, &c.

Active Principle.—Due to one of the *Tannins*, and of a mucilaginous nature. Beyond this little is known of its chemistry.

EXTRACTUM GUMMI RUBRI LIQUIDUM—LIQUID EXTRACT OF RED GUM—(*not official*).—*Take of red gum*, 1; *distilled water*, 3; *glycerine* 1, *to preserve.*

Dose.—10 to 40 minims.

SYRUPUS GUMMI RUBRI—SYRUP OF RED GUM—(*not official*). —*Take of liquid extract of red gum*, 1; *sugar*, 1. *Dissolve.*

Dose.—30 to 60 minims.

TROCHISCI—LOZENGES.—(*not official*)—*Each contain* 1 *grain.*

Therapeutics.—This has only been *official* since 1890, but previous to that time it was in the Pharmacœpia of the throat hospitals. On account of its astringency, it is useful in relaxed sore throat in the form of gargle, or applied in weak glycerine solution. In bleeding from the nostrils it is useful. In the strength of 1 in 120 as an astringent injection for the vagina in leucorrhœa, menorrhagia, cancer of the uterus, &c. It is a powerful deodorizer, and is especially useful in uterine cancer. In bleeding from the rectum it is also useful. Its chief uses, and those in which it is most successful, are in chronic dysentery and in diarrhœa affecting the lower bowel, and in these it often succeeds where kino and catechu fail. This is probably on account of its mucilaginous astringency. In dysenteric conditions it is best given in the form of pill freshly prepared with glycerine and tragacanth powder.

OTHER EUCALYPTI.—The oils of *E. piperita* and *E. hæmastoma* resemble peppermint in odour. *E. citriodora* oil has a smell like citron, and *E. staigeriana* is like oil of verbena. *E. resinifera*, or the Iron Bark Tree, yields an astringent resinous body called Australian or Botany Bay Kino. *E. mannifera*, *E. viminalis*, and other species yield from the leaves Australian manna, a saccharine substance resembling ordinary manna, and which yields *Eucalypton* or *Melitose* having the formula $C_{12}H_{22}O_{11}$, and which, on fermentation with yeast, gives *Eucalyptose* or *Eucalyn*, $C_6H_{12}O_6$. *E. obliqua* yields a bark said to be useful in paper-making. *E. Gunnii* yields a sweet fluid from the bark capable of fermentation.

Eugenia caryophyllata—The Clove Tree.

CARYOPHYLLUM—*Clove.*—The dried flower bud of *Eugenia caryophyllata*, Thunb. (*Caryophyllus aromaticus*, Linn.).

Collection and Preparation.—Either collected by hand or shaken off by long bamboo canes and caught in cloths placed beneath the tree. The collection is usually begun as soon as they have lost their green colour and become red. They are either dried in the sun or by artificial heat. The best cloves are plump and heavy. Our largest and best supplies come from Molucca and Zanzibar.

Characters.—About six lines long, dark reddish-brown, plump, and heavy, consisting of a nearly cylindrical body surmounted by four teeth and a globular head, with a strong fragrant odour, and a bitter, spicy, pungent taste. It emits oil when indented with the nail.[1]

[1] This shows that the oil has not been extracted.

Active Principles.—The chief is a *volatile oil.* They also contain a neutral, inodorous, tasteless substance, *caryophyllin*, $C_{20}H_{32}O_2$; a crystalline body, *eugenin*, $C_{10}H_{12}O_2$; *gum*; a *peculiar tannin*; and a little *salicylic acid*, $HC_7H_5O_3$, &c. The yield of oil from cloves is 16 to 20 per cent. The best oil is distilled in Great Britain. *Caryophyllin* treated with fuming HNO_3, and kept at a low temperature, yields *caryophyllic acid*, $C_{20}H_{32}O_6$.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Infusum.	Bruised cloves.	1 to 40.	1 to 4 fluid ounces.
Oleum.	Cloves.	(Yield 16 to 20 per cent.)	1 to 4 minims.

Also contained in *Infusum Aurantii Compositum; Mistura Ferri Aromatica; Vinum Opii.*

INFUSUM CARYOPHYLLI—INFUSION OF CLOVES.—*Take of cloves, bruised, ¼ ounce; boiling distilled water, 10 fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

OLEUM CARYOPHYLLI—OIL OF CLOVES.—The oil distilled in Britain from cloves.

Characters.—Colourless when recent, or pale yellow, but gradually becoming red-brown, having the odour of cloves and a pungent spicy taste. Sinks in water.[1]

[1] The specific gravity of the oil ranges from 1·034 to 1·065. It is soluble in all proportions in rectified spirit, ether, strong acetic acid, and in 1 to 60 of proof spirit.

Active Principles.—Oil of Cloves consists of two constituents; a colourless *light oil* or *terpene*, $C_{15}H_{24}$, having the specific gravity 0·918, boiling at 251° C., and having a turpentine-like odour, and *eugenol.* By distilling the oil with excess of caustic potash, *eugenate of potassium* remains in the retort and the *light oil* passes over. When the *potassium eugenate* is decomposed by an acid, *eugenic acid or eugenol*, $C_{10}H_{12}O_2$, is obtained. It is a colourless oil, having the specific gravity 1·076, boils at 247°·5 C., has a clove odour, forms crystalline salts, and fused with potash is decomposed into *proto-catechuic* and *acetic acids.* From *eugenic acid*, *vanillin* may be obtained by treating first with acetic anhydride and then with potassium permanganate. Oil of Cloves contains a small amount of *salicylic acid*, $HC_7H_5O_3$.

Contained in *Confectio Scammonii; Pilula Colocynthidis Composita; Pilula Colocynthidis et Hyoscyami.*

Incompatibles.—On account of the tannin present, cloves are incompatible with Salts of Iron, Lime Water, Mineral Acids, and Gelatine.

Therapeutics.—Cloves have an aromatic taste and odour, and agree in their medicinal properties, in most respects, with the other spices, their activity depending chiefly upon the volatile oil. They are used as a condiment with food; medicinally, they act as stimulants, carminatives, and stomachics, but they are rarely given alone. They are chiefly employed to give flavour, and to act as corrective adjuncts to other medicines. Applied to the skin and mucous surfaces, the oil produces at first a pleasant tingling sensation, followed by a hot uncomfortable feeling, and later on by local anæsthesia. It is thus useful in toothache. Mixed with olive-oil it forms a useful liniment in bronchitis and whooping-cough, in which the inhalation of the oil from the patient's chest may also have some effect. Taken into the stomach the oil irritates the gastric glands, and so acts as an appetiser. The oil is destructive to low forms of life, and is thus a good germicide. It is eliminated by the skin (in very small amount), bowel, and kidneys, and might thus be used in diseases of these organs dependent on organisms. (The oil is largely used to clarify microscopic sections prior to mounting in Canada balsam.)

Adulterations.—Mother cloves, or those which have been allowed to flower. They are much larger, and contain less oil. They are oftenest mixed with powdered cloves, and may be detected under the microscope, as they contain *large starch granules* not present in ordinary cloves. The *ground stalks* are also used to adulterate the powder; they only yield 4 to 8 per cent. of oil, and this forms a means of detection. *Adulterations of Oil of Cloves.*—When caustic potash is added, the smell disappears, and if Turpentine or Copaiba be present they can easily be thus detected, for their odour becomes more perceptible with KOH. The quality of the oil may be tested by estimating the percentage of eugenol in the form of benzoyleugenol. The yield ranges from 75 to 90 per cent. The best test is the specific gravity. Clove Oil cannot be distinguished chemically from *Pimenta Oil.* Carbolic Acid is often employed as an adulterant, and is detected by the blue or green colour given with ferric chloride.

Melaluca minor.—The Cajuput Tree—a native of the Indian and Malayan Archipelagos. Our chief imports of oil are from the Islands of the Straits Settlements, where it is distilled.

Oleum Cajuputi—*Oil of Cajuput—Oil of Cajiput—Kaiji-puti Oil.*—The oil distilled from the leaves of *Melaleuca minor*, Sm. (*Melaleuca Cajuputi*, Roxb.).

Preparation.—The leaves of the *Kaijuputi arbor alba,* or white wood trees, are allowed to undergo partial fermentation, and are then distilled with water.

Characters and Tests.—A transparent, limpid, volatile, pale bluish-green liquid, with a strong penetrating agreeable camphoraceous odour, and a warm bitterish aromatic camphoraceous taste, followed by a sensation of coldness in the mouth.[1]

Dose.—1 to 4 minims.

[1] Due to the presence of the Cajuputol. In addition to the B.P. characters, the following may be noted :—The oil remains liquid at $-13°$ C., and is levogyrate. The specific gravity ranges from 0·922 to 0·926 at 15°·5 C. When 5 c.c. each oil and dilute HCl are mixed, the green colour disappears.

Active Principles consist chiefly of *Hydrate of Cajuputene or Cajuputol*, $C_{10}H_{16},H_2O$, obtained from the crude oil by fractional distillation at 174° C. Repeated distillation over phosphoric oxide yields *Cajuputene or Cajuputol* (identical with *Cineol and Eucalyptol*), $C_{10}H_{16}$, and passes over at 160° to 165° C. It has an agreeable odour of hyacinth. After this, *Isocajuputene* distils over at 177° C. and *Paracajuputene* at 310° to 316° C., both having the same chemical composition as *Cajuputene.*

Colour.—The *natural* green colour of the oil is, on spectroscopic examination, seen to be oxidised *Chlorophyll.*

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Spiritus.	Oil.	1 in 50.	½ to 1 fluid drachm.

Contained also in *Linimentum Crotonis* (3½ in 8).

SPIRITUS CAJUPUTI—SPIRIT OF CAJUPUT.—*Take of oil of cajuput,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

Therapeutics.—Cajuput oil acts as a powerful diffusible stimulant, sudorific, and antispasmodic; it is allied in action to valerian and camphor, but does not produce mental disturbance in large doses as these do. It is not much used in this country; its reputation in cholera soon faded, and it is now only employed as a diffusible stimulant in cases requiring prompt rousing of the vital energies. It is occasionally employed in rheumatism, as a stimulating sudorific. Externally, combined with olive oil, it is used as a rubefacient liniment. Pharmacologically its action is similar to the other essential oils. It has been used, diluted with olive oil in skin diseases, such as eczema and psoriasis, and to allay toothache in the same way as clove oil. Its beneficial action in chronic rheumatism is probably due to the presence of the cajuputol. It is best administered on lump-sugar or in emulsion.

Adulterations.—*Copper,* to give it a more pronounced tint; to be detected by shaking up the oil with HCl dilute, and placing in a platinum vessel with a small piece of zinc. The copper will be deposited on the platinum, and after pouring off the liquid may be dissolved and tested with *ferrocyanide of potassium,* with which it gives a ruddy brown precipitate. Camphor Oil, which has specific gravity 0·944. Borneo Camphor Oil, specific gravity 0·880. Eucalyptus Oil was a former adulterant. Turpentine Oil, which diminishes the solubility in alcohol, and gives a more violent action with iodine.

Melaleuca descussata, R. Br.; *M. cricifolia,* Sm.; *M. genistifolia,* Sm.; *M. linarifolia,* Sm.; *M. squarrosa,* Sm.; *M. uncinata,* R. Br.; and *M. Wilsonii,* F. v. M.—all natives of Australia, yield oils similar in most respects to that obtained from *M. minor,* but differing in optical properties and specific gravity. In Australia the leaves of *M. scoparia* and *M. genistifolia* are used as substitutes for China tea.

Pimenta officinalis—The Allspice Tree.—The tree is evergreen, a native of the West Indies, South America, and Mexico ; cultivated in Jamaica. The berries are collected while green, and dried in the sun.

PIMENTA—*Pimento*—Allspice—Jamaica Pepper.—The dried unripe full-grown fruit of *Pimenta officinalis*, Lindl. (*Eugenia Pimenta*, D.C.).

Characters of the Berries.—One-fifth of an inch or more in diameter, brown, rough, crowned with the teeth of the calyx. Pericarp roughish from the presence of oil-glands, yellowish within, and containing a dark brown seed. Odour and taste aromatic, hot, and peculiar, resembling cloves.

Active Principles.—The most important is the *Volatile Oil. Tannin, gum, sugar, mucilage, resin, chlorophyll, colouring matter*, and *a volatile alkaloid* are also present. In odour the *alkaloid* resembles *Conine.*

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua Pimentæ.	Berries (bruised).	14 ounces to 1 gallon.	1 to 2 fluid ounces.
Oleum Pimentæ.	,,	...	1 to 4 minims.

AQUA PIMENTÆ—PIMENTO WATER.—*Take of pimento, bruised*, 14 *ounces ; water*, 2 *gallons. Distil one gallon.*

OLEUM PIMENTÆ—OIL OF PIMENTO.—The oil distilled in Britain from pimento.

Characters of the Oil.—Colourless, or slightly reddish when recent, but becoming brown by age, having the odour and taste of pimento. Sinks in water.

Dose.—1 to 4 minims.

Active Principles.—The oil has the specific gravity 1·020. By distillation with water, Allspice yields two *volatile oils*, one *heavier* and the other *lighter* than water. Ordinary oil of pimento is a mixture of these. Distillation with *caustic potash* separates the *light oil* (*Pimento-hydrocarbon*) which floats on water. HNO_3 has little effect on it. The residue from the caustic potash, distilled with H_2SO_4, gives the *heavy oil* (*Pimentic Acid*). It sinks in water, and is similar to *Clove Acid* or

Eugenic Acid. It forms *alkaline pimentates*, which become blue or green on adding Fe_2Cl_6 (ferric pimentate). HNO_3 acts violently on it, and reddens it.

Therapeutics.—Pimento—Allspice or Jamaica pepper—acts in accordance with its carminative, stimulant, and aromatic properties, which are derived from its volatile oil. It is not much used, and only as a flavouring or corrective adjunct or vehicle for other medicines. A tincture of pimento (1 to 5 of oil), made with rectified spirit, is used to paint on inflamed chilblains.

Adulterations.—Pimenta resembles cubebs and pepper, but the former has a stalk and the latter has no calyx.

The oil is subject to the same adulterations as Oil of Cloves. It resembles that oil in many ways, having an almost identical composition, but the odour is more delicate, and the specific gravity is lower.

MYRTI FRUCTUS—*Myrtle Berries*—(*not official*).—The dried ripe berries of *Myrtus communis*, a native of Persia, but cultivated in Southern Europe.

Fruit, a purplish black berry, about the size of a pea, with an agreeable odour, and a sweetish acid taste. It contains *sugar*, *citric and malic acids, and tannin.* Distillation with water gives (from flowers and leaves) an agreeable perfume, called by the French *Eau d'Ange.*

Therapeutics.—Aromatic and astringent.

MYRTUS CHEKAN—*Cheken—Chequen—Chekan*—(*not official*).

The leaves and shoots of *Myrtus chekan*, Sprengel (*Eugenia chekan*), a native of Chili. The leaves are important in that they resemble buchu leaves (*Barosma betulina*), but have the margin entire, and have a different smell. They contain a *volatile oil* like eucalyptus oil, a *volatile alkaloid* (*Chekanine*), and *tannin.*

Preparations from the leaves (*not official*).

INFUSION (1 in 10 boiling water).—*Dose*, 1 to 2 fluid ounces; *Fluid Extract* (1 in 1)—*Dose*, 2 to 3 fluid drachms.

SYRUP (1 to 2).—*Dose*, 2 to 4 fluid drachms. They are more palatable than eucalyptus preparations.

Therapeutically.—Employed in mucous catarrh of the pulmonary and urinary tracts.

MYRCIA ACRIS, D.C.— (Eugenia — Pimenta—Myrtus—Acris)—*Wild Clove—Wild Cinnamon—Bayberry.*—The leaves distilled with water are the source of the official spirit of Myrcia or Bay Rhum of the U.S.P., which is used chiefly as a hair-wash, either alone or with other ingredients. It is also used as a perfume, &c. Therapeutically it is of little importance, but is occasionally employed as a stimulant in faintness, &c.

Punica Granatum—The Pomegranate.

Habitat.—North of Africa, Syria, and Northern India, but cultivated in sheltered parts of Southern Europe. Pomegranate is the *Rimmon* of the Bible. The plant is placed in an independent order, Granateæ by some botanists, and in the order Lythraceæ by others.

GRANATI RADICIS CORTEX—*Pomegranate Root Bark.*—The dried bark of the root of *Punica Granatum*, Linn.

Characters and Tests.—In small quills or fragments varying from 2 to 4 inches in length. Outer surface yellowish-grey, wrinkled or marked with faint longitudinal striæ, or more or less furrowed with corky bands. Inner surface smooth or nearly so, and yellowish. Fracture, short. No odour. Taste astringent, and feebly bitter. An infusion becomes deep black-blue on the addition of a persalt of iron.[1] (The inner bark, steeped in water and rubbed on white paper, produces a yellow stain, which HNO_3 turns rose-red, soon fading away.[1])

[1] These serve to distinguish it from *Box* and *Barberry* Barks, with which it has been at various times adulterated.

Active Principles.—Contains 20 per cent. or more of *Tannins*—*ordinary tannin* and a *Punico-tannin* ($C_{20}H_{16}O_{13}$), which, when boiled with dilute H_2SO_4, is changed into *ellagic acid* and *sugar*. Traces of *gallic acid* are present. This large percentage of *tannin* has led to the use of the bark for tanning purposes. It also contains *Mannite*, $C_6H_{14}O_6$, formerly described under the names of *Granatin and Punicin.* Four alkaloids have been found in it, and may be separated as follows :—Mix the powdered bark with milk of lime, and exhaust with water. Shake up the infusion with chloroform, and neutralise the lime with dilute acid. A solution of the mixed alkaloids is thus obtained, which, when treated with excess of $NaHCO_3$, and agitated with chloroform, and this in turn shaken with dilute H_2SO_4, *Methylpelletierine* ($C_9H_{17}NO$) and *Pseudo-pelletierine* ($C_9H_{15}NO$) are obtained in the form of sulphates. Caustic potash is then added to the first liquor, and the treatment with chloroform and dilute acid repeated, when the sulphates of *Pelletierine* and *Isopelletierine* are obtained. *Pelletierine* is also called *Punicine*, and has the formula $C_8H_{13}NO$. *Pelletierine* and *Isopelletierine* are the most active. *Pseudo-pelletierine* is liquid, the others are solid. The yield of alkaloid ranges from 0·4 to 1 per cent. *Pelletierine* is readily soluble in water, alcohol, ether, and most of all in chloroform. It combines with acids to form crystallisable hygroscopic salts.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Sliced Root Bark.	2 ounces to 1 pint.	2 to 4 fluid ounces.

DECOCTUM GRANATI RADICIS—DECOCTION OF POMEGRANATE ROOT.—*Take of pomegranate root-bark, sliced, 2 ounces; distilled water, 2 pints. Boil down to a pint, and strain, making the strained product up to a pint, if necessary, by pouring distilled water over the contents of the strainer.*

EXTRACTUM GRANATI—EXTRACT OF POMEGRANATE—(*not official*).—*Pomegranate root-bark exhausted with proof spirit, and evaporated to the consistence of an extract.*

Dose.—7 to 10 grains.

PELLETIERINE SULPHATE (Deliquescent)—(*not official*).

Dose.—6 to 7 grains.

PELLETIERINE TANNATE—(*not official*).—Yellow powder. The dose is given variously by different authors, the reason being that its action has never been accurately investigated.

Dose.—$\frac{1}{2}$ to 8 grains.

GRANATI FRUCTUS CORTEX—*Pomegranate Fruit Bark*—(*not official*).—The *fruit* is about the size of a large orange, its apex crowned by the thick tubular toothed calyx. It has a hard smooth coriaceous rind, which, when the fruit is ripe, assumes a yellowish tint, often shaded with red. Internally it is divided up into a number of cells by vertical and transverse divisions—the latter being supposed to result from an outer row of carpels being brought to overlap the inner row during development. The numerous seeds are embedded in a reddish juicy pulp. The fruit bark, as met with in commerce, is in irregular more or less concave pieces, some of which have remains of the toothed calyx attached. It is $\frac{1}{12}$ to $\frac{1}{10}$ inch thick, externally rather rough, of a yellowish or reddish-brown colour, breaking with a corky fracture ; internally it is more or less brown or yellowish, and shows numerous depressions left by the seeds. It is odourless, has a strong astringent and slightly bitter taste. It is unfortunate that the Pharmacopœia has not made this bark official, because collection of root-bark necessitates destruction of a whole tree ; and those whose experience is largest say the fruit-bark is quite as active as the root-bark.

Incompatibles.—As for tannin.

Therapeutics.—Pomegranate is astringent in all its parts, due to the presence of tannin. In large doses the root-bark causes nausea and purging, and occasionally vomiting and vertigo. It has been recommended as a vermifuge in tape-worm, but it often fails to remove the worm. The rind of the fruit is occasionally used for the sake of its astringency in relaxed throats and mucous discharges. The ripe fruit may be eaten as a slightly astringent, refreshing refrigerant in febrile cases, especially of the bilious type. Its efficacy as a vermifuge depends on the pelletierine and isopelletierine, and perhaps it would be better to give the alkaloids themselves. For expelling tape-worm it is used as follows :—The bowel is to be cleared by a castor-oil purge, followed by the decoction in divided doses every hour, the last being followed by a dose of castor-oil. The official dose of the decoction is frequently much exceeded. The alkaloids have not been thoroughly investigated, but it has been shown that in large doses in man they produce muscular weakness, and in the higher animals paralyse motor nerves, leaving the sensory nerves unaffected, thus resembling curare.

Adulterations.—Stem-bark, which is not so active, is frequently found mixed with the root-bark. It possesses less cork, and its outer surface is occasionally marked with lichens, and under the microscope chlorophyll deposits can be seen. *Box* and *Barberry* barks are to be detected by the tests already mentioned. Root-bark should be carefully freed of adhering wood which is inert.

Nat. Ord. **LYTHRACEÆ**—The Loosestrife Order—(*not official*).

Habitat.—Europe, North America, Australia. Contain *tannin, mucilage, chlorophyll.* Formerly used in dysentery, especially in Ireland; but now replaced by more reliable remedies. The best-known plant of the order is *Lythrum salicaria, Loosestrife or Purple Willow Herb,* and which grows in Britain, and may be given in 1 drachm doses of the dried herb three times a day, made into infusion or decoction.

Nat. Ord. **TURNERACEÆ**—The Turnera Order—(*not official*). —Natives of South America and the West Indies.

DAMIANA is the name given to the leaves derived from *Turnera microphylla;* and *T. aprodisiaca.* The leaves of *Haplopappus discoideus,* D.C. (Compositæ) have also been sold as Damiana.

Composition.—An amber-coloured, bitter, camphoraceous, *volatile oil; tannin, tasteless resins,* and *extractives.*

EXTRACTUM DAMIANÆ LIQUIDUM—LIQUID EXTRACT OF DAMIANA—(*not official*).—*The leaves are exhausted with proof spirit, so that one of the extract represents one of the leaves.*

Dose.—30 to 60 minims.

Therapeutics.—Merely a tonic. It has been largely advertised by enterprising druggists as a powerful aphrodisiac and nerve stimulant, possessing non-poisonous properties, but it is neither nerve-stimulant nor aphrodisiac.

Nat. Ord. **PAPAYACEÆ**—The Papaw Order—(*not official*). —Natives of South America and the warmer parts of the Old World.

The most important genus is *Carica. C. digitata* yields a milky juice which is said to be poisonous. *C. papaya* is the one represented in medicine. The juice of the unripe fruits and the powdered seeds are anthelmintic. The cooked fruit is used as food. The powdered seeds have a reputation in Southern India as a powerful emmenagogue, but it is doubtful if they possess this property ; and the fact of abortion having taken place after eating the fruit is probably only a coincidence, abortion being common in India. The leaves of the tree are used as a substitute for soap in some parts of India.

Papain or Papayotin.—The milk obtained by scratching the unripe fruit of the Melon Tree or Papaw, *C. papaya*, Linn., has an acid reaction and a bitterish astringent taste, with a specific gravity of 1·023. On standing a few minutes it separates into two portions—a watery fluid and an amorphous pulpy mass. In the watery portion is an albuminous substance named *Papain* or *Papayotin.*

Characters.—Pure *Papain* is an amorphous powder, whitish in appearance, resembling gum-arabic powder, 75 per cent. being soluble in alcohol, showing absence of admixture of albumin. It is the pure ferment, combined with albumin, obtained by precipitation with absolute alcohol, the bulk of albumin being removed by precipitation with lead acetate.

Active Principles of the Juice.—Papain, resins, fatty matter, malic acid, a caoutchouc-like substance, &c. It also contains a *milk-curdling ferment.* No *peptone* is to be found in the juice,—only *albumin, globulin,* and *proteoses. Leucine* and *tyrosine* are, however, present. It has not yet been proved that *papain* changes albumin into *peptone ;* the change probably goes no further than *albumose.*

Papain acts in neutral, acid, or alkaline solution, but best in the latter. Glycerine is a solvent of it, and does not impair its digestive powers. Its action is not checked by carbolic acid. It digests 200 times its own weight of pressed fresh blood-fibrin.

Dose.—1 to 8 grains suspended in water. For peptonising milk use 7 grains to the pint.

Therapeutics.—It is given in dyspeptic conditions in the form of elixir or glycerine, and made so that the dose is 1 fluid drachm. As a solvent for diphtheritic membrane in 5 per cent. solution in glycerine. It is useful in syphilitic ulcers of the tongue in lozenge form, each containing ½ grain, or in solution (1 to 10) of dilute glycerine. It has also been recommended, to destroy warts and epithelioma, and in renal calculi in the form of 1 to 3 grain pills. The natives of the West Indies use the unripe fruit, split open, and rubbed over the surface of meat previous to cooking, by which treatment the toughest meat is made tender. Injected into the circulation in large doses it paralyses the heart, and in this it resembles peptone.

Nat. Ord. **CUCURBITACEÆ**—The Gourd or Cucumber Order. —Succulent climbing plants, chiefly inhabitants of hot climates, abounding in India and South America. The plants generally possess acrid, bitter, and drastic properties, but many of the cultivated fruits are edible.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Citrullus Colocynthis.	Dried peeled fruit, freed from seeds.	Northern Africa, Syria, and Spain.
Ecballium Elaterium.	Nearly ripe fruit.	Britain.

Citrullus colocynthis—Colocynth—Bitter Cucumber—Bitter Apple.

Habitat.—Southern shores of the Mediterranean, Japan, Coromandel Coast, Cape of Good Hope ; but cultivated in Spain and France. The fruit is a Pepo or Gourd, about the size of an orange, with a leathery, brownish rind. It is gathered in the autumn when ripe and yellow, peeled and dried either in the sun or by stoves.

Colocynthidis Pulpa—*Colocynth Pulp.*—The dried peeled fruit freed from seeds, of *Citrullus colocynthis*, Schrad. (*Cucumis colocynthis*, Linn.).

Characters and Tests.—As imported, it is usually in more or less broken balls, whitish, 2 inches or less in diameter, roundish, very light, spongy, tough, and consisting of the pulp in which the seeds are imbedded. The broken-up pulp freed from seeds is the condition in which it is usually supplied to the pharmacist, and is the only official condition. This pulp is light, spongy, whitish, without odour, and of an intensely bitter taste. The powder is not coloured blue by iodine,[1] and does not yield oil when treated with ether and the ether evaporated.[2] (Mogador colocynth is larger than European colocynth, is unpeeled, and is chiefly used as an insecticide. Used to be put in druggists' show-bottles.)

[1] Absence of starch. [2] Absence of seeds which contain the oil.

COLOCYNTHIDIS SEMINA—*Colocynth Seeds*—(*not official*).

The seeds constitute three-fourths of the weight of colocynth, and contain 17 per cent. of fatty oil. They have only a faint bitter taste, even when crushed and roasted or boiled; are used as food by tribes of the Sahara. Flückiger and Hanbury state that the pulp, free from seeds, yields 11 per cent. of ash; the seeds alone only yield 2·7 per cent.

Active Principles.—Colocynth contains about 10·25 per cent. of a glucoside, *Colocynthin*, $C_{56}H_{84}O_{23}$, which can be extracted by precipitation with K_2CO_3 from a concentrated aqueous infusion, and crystallisation from absolute alcohol. On hydrolysis, *colocynthin* splits up into *glucose* (2 mols) and *Colocyntheïn*, $C_{44}H_{64}O_{13}$, a resinous body. *Colocynthitin*, a tasteless crystalline powder, probably a resin, is that part of the *alcoholic extract* of colocynth which is soluble in ether but not in water. It is stated, on the authority of Johannson, that on heating *colocynthin* with dilute H_2SO_4 it gives *colocyntheïn*, *elaterin*, and *bryonin*. *Colocynthin* is a bitter yellowish-brown, translucent, friable substance, soluble in water and in alcohol, but not in ether. *Pectin*, *gum*, *mucilage*, *fixed oil*, *salts*, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum Compositum.	Dried Pulp.	1 in 4½ nearly.	3 to 10 grains.
Pilula Composita.	Dried Pulp Powder.	1 in 6 nearly.	5 to 10 grains.
Pilula Colocynthidis et Hyoscyami.	Compound Pill of Colocynth.	1 in 9 nearly (of pulp).	5 to 10 grains.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM—Compound Extract of Colocynth.—*Take of colocynth pulp, 6 ounces; extract of socotrine aloes, 12 ounces; resin of scammony, 4 ounces; curd soap, in powder, 3 ounces; cardamom seeds, in fine powder, 1 ounce; proof spirit, 1 gallon. Macerate the colocynth in the spirit for four days; press out the tincture and distil off the spirit, then add the aloes, scammony, and soap, and evaporate by a water-bath until the extract is of a suitable consistence for forming pills, adding the cardamoms towards the end of the process.*

Curd soap is now used instead of hard soap. If all the substances were macerated together and then dried and powdered, an uniformly smooth compound could be formed. This cannot be obtained by the above process. The cardamom seeds (in powder) are added at the end of the process, in order to prevent evaporation of volatile oil during heating.

PILULA COLOCYNTHIDIS COMPOSITA—Compound Pill of Colocynth.—*Take of colocynth pulp, in powder, 1 ounce; Barbadoes aloes, in powder, scammony, in powder, of each, 2 ounces; sulphate of potash, in powder, ¼ ounce; oil of cloves, 2 fluid drachms; distilled water, a sufficiency. Mix the powders, add the oil of cloves, and beat into a mass with the aid of the water.*

Made as directed, this pill soon becomes very hard and shapeless, and when kept long may pass through the canal unacted upon. Treacle, syrup, glycerine, glycerine of tragacanth, or liquor potassæ make a good mass. This pill is known as Dr. Gregory's Pill. Two grains of powdered tragacanth, added to 60 grains of this or the following pill, makes a mass which, when cut into pills, do not lose their globular shape on keeping.

PILULA COLOCYNTHIDIS ET HYOSCYAMI—Pill of Colocynth and Hyoscyamus.—*Take of compound pill of colocynth, 2 ounces; extract of hyoscyamus, 1 ounce. Beat them into a uniform mass.*

This formula was a favourite of Christison and Hamilton, and the pills are sold as Hamilton's and Christison's pills.

Therapeutics.—Colocynth in small doses, and in one of the above combined forms, is a useful purgative, acting both on the muscular and secreting structures of the bowels, and giving an impetus to the abdominal viscera generally. It also acts somewhat as a diuretic. In large doses it is a powerful hydragogue and drastic cathartic. In excessive doses it proves fatal by causing gastro-intestinal inflammation, attended with severe griping and most excruciating pains. Professor Christison mentions a case in which a tea-spoonful and a-half, or about ninety grains, of the powder proved fatal. Colocynth acts chiefly upon the large intestines, not only as a topical irritant, but also by the absorption of its active principle into the circulation. It acts in the same way when injected directly into the blood or subcutaneous spaces. It acts on the urinary system, in large doses producing inflammation. It increases the biliary secretion in both its solid and watery parts. It also stimulates the pelvic viscera, and is useful as a purgative in habitual constipation, as a derivative in head cases, as a hydragogue in dropsies, &c., but is contra-indicated in abdominal inflammations, in pregnancy, in menorrhagia, &c. It has been lately shown that it is possible to detect colocynthin in the discharges from the bowel. Concentrated H_2SO_4 gives with it a yellowish-red tint, soon turning to red.

Antidotes.—Demulcents, with opium in large doses to overcome the pain.

Substitutions.—*Cucumis trigonus*, with spherical, elongated, somewhat obscurely trigonus bitter fruits. *Cucumis Hardwickii*, or Hill Colocynth, has oval or oblong bitter fruits. Mogador Colocynth is much larger than the Turkey or official variety, and is inferior in quality.

Ecballium Elaterium—Wild or Squirting Cucumber—Gourd.

Botany.—*Annual.* *Stem*, trailing, hispid, scabrous, glaucous, without tendrils. *Leaves*, on long bristly stalks, cordate, somewhat lobed, crenately toothed. *Flowers*, axillary, monœcious, yellow. *Fruit*, a pepo, muricated, elliptical, one inch and a-half long. When ripe it separates from its stalk and forcibly ejects its juice and seeds through the basillary aperture at the point which was previously in contact with the stalk, hence called *squirting* cucumber. *Seeds*, brown compressed reticulate. *Habitat*, South of Europe. Cultivated at Hitchin, in Herts, and Mitcham, in Surrey. It *flowers* in July, and *fruits* in August. It grows on poor soil.

Ecballii Fructus — Elaterii Fructus — Cucumis Asinus — Cucumis Agrestis—*Squirting Cucumber Fruit.*—The nearly ripe fruit of *Ecballium Elaterium*, A. Rich. (*Momordica Elaterium*, Linn.).

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Elaterium.	Nearly ripe fruit.	Yields 25 or not less than 20 % of Elaterin.	$\frac{1}{16}$ to $\frac{1}{2}$ grain.

ELATERIUM — EXTRACTUM ELATERII — ELATERIUM.— *Take of squirting cucumber fruit, very nearly ripe,* 1 *pound. Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve, and set it aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter, and dry it on porous tiles with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way.*

Characters and Tests.—In light friable slightly incurved cakes, about one line thick, greenish-grey, acrid and bitter; fracture finely granular. Strikes little or no blue colour with iodine.[1] Does not effervesce with acids;[2] yields half its weight to boiling rectified spirit. This solution, concentrated and added to warm solution of potash, yields on cooling not less than twenty per cent. of elaterin in colourless crystals.[3]

Dose.—$\frac{1}{16}$ to $\frac{1}{2}$ grain.

[1] Absence of starch, a common adulterant. [2] Absence of calcium carbonate or chalk. [3] The Pharmacopœial process of estimating the active principle (*Elaterin*) is faulty, a large loss taking place in the mother liquors; a better method is to exhaust the drug with chloroform, evaporate, wash the residue (impure *Elaterin*) with ether, and again dissolve in chloroform and crystallise.

Commercial Elaterium is a variable drug, that prepared in Britain being usually superior (frequently yielding 30 per cent. of Elaterin) to the Continental variety, which is systematically adulterated with chalk and flour. The Continental or Maltese variety is in larger and thicker pieces, sinks in water, and yields only 2 to 10 per cent. of *Elaterin.* The yield of Elaterium from the juice is extremely small—about half an ounce from a bushel, or 0·12 per cent.—that surrounding the seeds being the most active in yield. The nearer to maturity the larger the yield; but, as it is impossible to handle the ripe fruit on account of the spontaneous dehiscence, the Pharmacopœia orders it to be collected when nearly ripe.

Active Principles.—Good Elaterium contains 20 to 30 per cent. of a neutral, bitter, crystalline principle *Elaterin*, $C_{20}H_{28}O_5$, to which its physiological activity is entirely due. It also contains *chlorophyll*, *starch*, and *cellular tissue*. However, when carefully prepared, *starch* and *cellular tissue* are absent.

Therapeutics.—Elaterium acts topically as an irritant. Those who prepare it suffer from inflammation and ulceration of the fingers produced by handling the sliced fruit; and when the juice accidentally comes in contact with the conjunctiva it causes intense pain and subsequent inflammation. Internally, it acts topically by irritating the mucous membrane of the stomach and bowels, causing both vomiting and purging. One-eighth of a grain of good elaterium purges violently, equal to the effects produced by one-sixteenth to one-twelfth of a grain of elaterin; but the elaterium of the shops is seldom quite pure, and about double that quantity is required for a full dose. It is a violent drastic, hydragogue, cathartic, causing severe griping and numerous liquid evacuations. It is chiefly employed in passive dropsies; it is prompt, energetic, and certain in its effects, and reduces the effused fluid more effectually than any other remedy of its class both in anasarca and ascites, and often succeeds in such cases when other purgatives and diuretics have failed. It may be given either in one full dose, taking care to support the patient during its operation, or, better, in small doses, repeated at intervals of five or six hours, till free evacuation of the bowels takes place. It is contra-indicated in cases complicated with inflammatory symptoms of the stomach or bowels, and also in extreme debility. It is occasionally employed as a derivative in head cases, and as an active purgative in obstinate constipation. It has been recommended also in certain forms of gout, but its chief employment is in dropsies. Give it in combination with extract of hyoscyamus, especially in renal disease (HARLEY), to prevent it causing persistent diarrhœa; and in dropsy from cardiac disease (HOPE), with some stimulant to prevent depression, which may be dangerous in these cases. It only acts as a purgative in contact with the bile; and, when injected subcutaneously, it would appear to act chiefly, if not entirely, on the nervous system, producing a condition of tetanus.

Antidotes.—Demulcents, enemata, opium in small doses, and stimulants to prevent collapse.

Adulterations.—Chalk and starch, but most of all, perhaps, by the juice being expressed too much, whereby the active principle is proportionately diminished. The *B.P.* tests admit of them all being readily detected.

ELATERINUM—ELATERIN—MOMORDICIN, $C_{20}H_{28}O_5$.

Preparation.—May be obtained by exhausting elaterium with chloroform, adding ether to the chloroformic solution, collecting the precipitate, washing it with ether, and purifying by recrystallisation from chloroform.

Character and Tests.—A chemically-neutral substance. In small colourless crystals; insoluble in water, sparingly soluble in rectified spirit.[1] Taste bitter. Heated with access of air, it first melts and then burns, leaving no residue. With melted carbolic acid it yields a solution which, on the addition of sulphuric acid, acquires a crimson colour rapidly changing to scarlet.[2] It is not precipitated from solution by tannic acid, nor by the salts of mercury or platinum.[3]

[1] It is readily soluble in boiling alcohol, amylic alcohol, and carbon bisulphide. [2] It is but little coloured by cold concentrated H_2SO_4. Its crystals are in hexagonal scales or prisms. [3] Absence of alkaloids.

Chemistry.—Caustic potash added to a boiling alcoholic solution of *Elaterin* produces a liquid which is no longer precipitable by water, and is converted into an *Acid* body, separable on supersaturating the solution with a mineral acid.

Dose.—$\frac{1}{40}$ to $\frac{1}{10}$ grain.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Pulvis Compositus.	Elaterin.	1 in 40.	$\frac{1}{2}$ to 5 grains.

PULVIS ELATERIN COMPOSITUS—COMPOUND POWDER OF ELATERIN.—*Take of elaterin,* 5 *grains; sugar of milk,* 195 *grains. Rub them together in a mortar until they are reduced to fine powder and intimately mixed.*

Elaterin is now employed instead of elaterium, as in the 1867 Pharmacopœia.

Therapeutics.—*Elaterin* has only been introduced into the Pharmacopœia lately, although the advantage it possesses on account of its constant strength has been frequently advocated by the highest medical authorities. In its action it practically differs in no way from elaterium, proving that, therapeutically, the other ingredients of that drug are of little account. It is usually prescribed in the form of pill, and is frequently combined with extract of henbane. This combination prevents griping.

Antidotes.—See Elaterium.

Cucurbita pepo—Pumpkin—White Gourd—U.S.P.—(*not official*).—The seeds are official in the U.S.P. They contain *fixed oil, resin, sugar, albumin, colouring matter, starch, volatile oil,* and a supposed glucoside *Cucurbitin.* The plant is now cultivated all over the globe. The seeds are crushed and given in the early morning in one to two ounce doses, as a remedy against tape-worm. Three or four hours afterwards, one or two tablespoonfuls of castor-oil are given.

The seeds of *Cucurbita maxima* have similar properties.

Cucumis sativa—Cucumber—(*not official*).—Like *C. trigonus* and *C. Hardwickii*, natives of the East Indies, and are reputed to be laxative and diuretic. Cucumber has enjoyed a reputation as being emollient to the skin in the form of ointment, best prepared by mixing one part of distilled *spirit of cucumber* with 7 parts of *benzoated lard;* the spirit being prepared by distilling 1 part of grated cucumbers with 3 parts of diluted alcohol, and retaining the first 2 parts which come over.

C. citrullus—The Water Melon—(*not official*).—Has been used as a diuretic in the form of infusion (1 to 10 of bruised seeds).

C. ovifera saccade is the well-known vegetable marrow. These are cultivated in the United States and Great Britain—(*not official*).

Feuillea cordifolia—(*not official*).—Has intensely bitter seeds. The fruit is said to be an antidote to strychnine.

Luffa—*L. purgans* and *L. drastica*—(*not official*).—Possess bitter properties, and are known as American colocynth.

Luffa ægyptica—Towel Gourd—Vegetable Sponge—Wash—Rag Sponge—(*not official*).—Indigenous to Arabia and Egypt. Has a gourd-like fruit, and when the epidermis is removed the pericarp presents an interwoven woody-fibrous body, to which the name of "Loofah" has been given, and which is used in the bath in place of a sponge.

Trianosperma (Bryonia) ficifolia—Tayuru—Leroy vegetel—(*not official*).

Habitat.—Brazil and Argentine Republic.

Active Principle.—Tayurin or Tayuyin.

Therapeutics.—Purgative and emetic. Used in the form of tincture of the root (1 to 4 proof spirit) in *dropsy* and *tertiary syphilis.*

Bryonia dioica—Vitis alba—Bryony—Bryonia—White Bryony—also by herbalists called Mandrake Root—(*not official*). Official in the U.S.P.

Botany.—A perennial, climbing, herbaceous plant, inhabiting hedges and thickets. *Leaves*, palmate, five-lobed, dentate, rough on both sides with callous points. *Flowers*, diœcious, calyx of the fertile flower half as long as the corolla. *Fruit*, a red berry.

Bryonia alba—(*not official*).—Is so closely allied to the above as by some to be called merely a variety of the same species. It has monœcious *flowers* and black *berries*; its *calyx* is as long as the *corolla*.

The *roots* of both plants are gathered for use, and are, when fresh, spindle-shaped, sometimes branched, one to two feet long, as thick as the arm, externally yellowish-grey and circularly wrinkled within, white, succulent and fleshy, odour nauseous, and taste disagreeable. The following are the U.S.P. characteristics :—" In transverse sections, about 2 inches in diameter; the bark grey-brown, rough, thin; the central portion whitish or greyish, with numerous small wood bundles, arranged in circles, and projecting radiating lines; inodorous; taste disagreeably bitter."

Active Principle.—A bitter glucoside, *Bryonin*, $C_{48}H_{80}O_{19}$, which when treated with acids, is broken up into *sugar*, *bryoretin*, $C_{21}H_{35}O_7$ (soluble in ether), and *hydrobryoretin*, $C_{21}H_{37}O_8$ (insoluble in ether). *Bryonin* is soluble in water and alcohol, and in H_2SO_4, with the production of a blue colour. It is insoluble in ether. It has a very bitter taste. Alkalis have no effect upon it.

TINCTURA BRYONIÆ—Tincture of Bryony, B.P.C.—(*not official*).—*Prepared from bryony-root of such a strength that it shall represent a tincture containing* 1 *of dried root in* 10 *of proof spirit.*

Dose.—1 to 10 minims.

Therapeutics.—Formerly bryony was used in dropsy, but not now. It has long been a favourite homeopathic remedy, and within the past few years it has been lauded as a specific for the pain of acute pleurisy. We have seen it given in a large number of cases, and in twice the maximum dose up to 3 drachms of the tincture, without having the least effect in allaying the pain, and we thus believe it to be worthless. In large doses it is emetic and purgative, producing symptoms like the onset of cholera. Topically it has been applied to bruises in the same manner as tincture of arnica. The dose of the powdered root is ⅓ to 1 drachm.

Nat. Ord. **CACTACEÆ**—The Cactus Order—(*not official*).—Succulent plants, usually spiny and leafless. Natives of tropical America.

Cactus (Cereus) grandiflorus—Night Blooming Cereus.—The parts used are the flowers and young stems. We have found the flowers to contain *wax*, *resins*, *volatile oil*, *sugar*, a colouring body possibly allied to *anthoxanthin*, but *no alkaloid;* but our investigations are not yet completed. The preparation most in use is a tincture made with rectified spirit, 1 in 5, or, better, 1 in 20.

Dose.—1 to 5 minims of the tincture (1 in 5).

Therapeutics.—Said to be tonic to the heart and nervous system, as well as diuretic, having all the properties of digitalis, but without being cumulative.

Belonging to the same order we have **Opuntia vulgaris**, the Prickly Pear, used as a dessert fruit. **O. cochinillifera**, the Nopal Plant, is cultivated in Teneriffe and Mexico for the nourishment of the Cochineal insect (*Coccus cocti*).

Nat. Ord. **UMBELLIFERÆ or APIACEÆ**—The Umbelliferous Order.—Herbs or small shrubs, with solid or hollow stems, inhabiting the northern parts of the northern hemisphere, and a corresponding elevation upon the high mountains of the tropics. The properties of the plants are various; some are edible, some act as acro-narcotic poisons, some as stimulants and tonics due to a volatile oil, others as antispasmodics due to the presence of a fetid gum-resin.

Official Plants.

Name.	Part Used.	Habitat.
Carum Carui.	Dried fruit.	Britain and Germany.
Carum Ajowan.	Stearoptene.[1]	India and France.
Conium maculatum.	Fresh leaves and young branches, and dried fruit.	Britain.
Coriandrum sativum.	Dried fruit.	"
Fœniculum capillaceum.	"	Central & S. Europe, India, and China.
Peucedanum graveolens.	"	Southern Europe.
Pimpinella Anisum.	"	"
Dorema ammoniacum.	Gum-resin.	Persia.
Ferula Sumbul.	Dried root.	India and Russia.
Ferula Narthex, F. Scorodosma, and other species.	Gum-resin.	Punjaub and Afghanistan.
Ferula galbanifula, F. rubricaulis, and other species.	Gum-resin.	Persia.

[1] Will be dealt with under *Labiatæ*.

Carum Carui—Caraway—*Carvy* (Scotch).

Botany.—Biennial. *Root,* fusiform. *Stem,* branched, about two feet high. *Leaves,* bipinnate. *Flowers,* white or pale flesh colour. *Mericarps,* or seeds, as they are commonly called, one and a-half to two lines long, slightly curved inwards, with five primary ridges of a lighter colour than the rest, which is brownish ; they have a peculiar aromatic agreeable odour, and a warm taste, due to a volatile oil contained in the vittæ or oil cells. *Habitat,* meadows and pastures throughout Europe ; cultivated in Essex.

CARUI FRUCTUS—*Caraway Fruit.*—The dried fruit of *Carum Carui,* Linn.

Characters of the Fruit or Mericarp.—Fruit usually separating into two constituent mericarps, which are about two lines long,[1] curved, tapering at each end, brown, with five paler longitudinal ridges ; and in each of the intervening spaces there is a large and conspicuous vitta,[2] having an agreeable aromatic odour, and a spicy sweetish taste.

[1] The length distinguishes them from the fruit of *Carum Ajowan,* which are $\frac{1}{16}$ to $\frac{1}{10}$ inch long. [2] Anise fruit exhibits 15 vittæ or oil tubes.

Active Principle.—Contains about 5 per cent. of a *volatile oil.* Caraway Oil is a mixture of a hydrocarbon ($C_{10}H_{16}$), named *Carvene,* with an oxygenated oil ($C_{10}H_{14}O$), called *Carvol* or *Carvacrol. Carvene* boils at 173° C., and forms with dry HCl crystals of $C_{10}H_{16}+2HCl$. *Carvol* boils at 224° C. It forms crystals of $(C_{10}H_{14}O)_2SH_2$ with H_2S. *Carvol* also exists in dill and an oil of the same percentage-constitution is said to exist in spearmint. Both *Carvene* and *Carvol* turn a ray of light to the right (dextrogyrate), the former being the stronger.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Bruised fruit.	1 pound to 1 gallon.	½ to 2 fluid ounces.
Oleum.	Fruit.	(Yields about 5 per cent.)	1 to 4 minims.

Contained also in *Confectio Opii* (1 in 10) ; *Confectio Piperis* (3 in 20) ; *Pulvis Opii Compositus* (1 in 2½) ; *Tinctura Cardamomi Composita* (1 to 80) ; *Tinctura Sennæ* (1 to 40).

AQUA CARUI—CARAWAY WATER.—*Take of caraway fruit, bruised,* 1 *pound; water,* 2 *gallons. Distil* 1 *gallon.*

OLEUM CARUI—OIL OF CARAWAY.—The oil distilled in Britain from caraway fruit.

Characters.—Colourless or pale yellow when recent, but gradually becoming darker, with the odour of the fruit, and a spicy somewhat acrid taste.

Contained in *Confectio scammonii* (1 in 75); *Pilula Aloes Barbadensis* (1 in 32).

Therapeutics.—Caraway seeds are chiefly used in confectionery and as a flavouring for cakes, cheese, and bread. As a medicine they are aromatic, carminative, and somewhat stimulant. The oil and the water are chiefly used as corrective and flavouring adjuncts or vehicles to other medicines, and occasionally the water is used in tea-spoonful doses to relieve the flatulent colic (gripes) of infants. The oil, diluted with olive-oil (1 to 5), is used as a rubefacient in the whooping-cough and bronchitis of children.

Adulterations and Substitutions—Of the Fruit.—Ajowan, the fruit of *Carum Ajowan*, are, however, smaller, being only $\frac{1}{16}$ to $\frac{1}{10}$-inch long. Common parsley fruit is smooth and inodorous, although at first sight it resembles somewhat the official caraway.

Of the Oil.—The oil is occasionally adulterated with Oil of Turpentine, the latter having been mixed with the fruit previous to distilling. The dextro-rotatory power is much less than that of the pure oil, and on heating with caustic potash the turpentine odour is detected. Fixed oils and alcohol are also employed as adulterants; the former leaves a permanent stain on paper, the latter colours dry fuchsine when shaken up with it.

Conium maculatum — Cicuta maculata — Hemlock — Poison Hemlock—Spotted Hemlock.

Botany.—*Root*, biennial, tap-shaped, fusiform, whitish, 6 to 12 inches long. *Stem*, round, smooth, glaucous, shining, spotted, hollow, 2 to 6 feet high; the spots are dark purple. *Leaves*, tripinnate, with lanceolate pinnatifid leaflets, which are dark green, shining, and smooth, and emit a disagreeable odour when bruised. *Umbels*, consist of general and partial rays. *Fruit*, ovate, compressed laterally; the seed has a deep hollow groove in front. *Habitat*, hedgerows and waste places in this and other European countries; also in North America and Eastern Asia.

CONII FOLIA—*Hemlock Leaves.*—The fresh leaves and young branches of *Conium maculatum*, Linn., gathered from wild plants when the fruit begins to form.

Characters and Test.—More or less divided in a pinnate manner; the lower leaves decompound, and sometimes 2 feet in length, glabrous, and arising from a smooth stem, which is marked with dark purple spots,[1] by clasping petioles of varying lengths, those of the lower leaves being hollow. Odour strong and very disagreeable, more especially when rubbed with solution of potash.[2]

[1] This distinguishes it from the other common umbelliferous plants—*Aethusa cynapium, Oenanthe crocata, Cicuta virosa, Myrrhis odorata, Myrrhis temulenta.* [2] This disengages the alkaloid *Conine*, the potash neutralising the acid with which it is combined.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Fresh leaves and young branches.	...	2 to 6 grains.
Succus.	"	...	$\frac{1}{2}$ to 1 fluid drachm.

EXTRACTUM CONII—Extract of Hemlock.—*Take of the fresh leaves and young branches of hemlock,* 112 *pounds.*

This belongs to the same class of extracts as Extract of Aconite, and is prepared in the same way. (See Extract of Aconite.)

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Pilula Composita.	Extract.	$2\frac{1}{2}$ in 3.	5 to 10 grains.

PILULA CONII COMPOSITA—Compound Pill of Hemlock.—*Take of extract of hemlock,* $2\frac{1}{2}$ *ounces; ipecacuanha, in powder,* $\frac{1}{2}$ *ounce; treacle, a sufficiency. Mix the extract of hemlock and ipecacuanha, and add sufficient treacle to form a pill-mass.*

SUCCUS CONII—Juice of Hemlock.—*Take of fresh leaves of hemlock,* 7 *pounds; rectified spirit, a sufficiency. Bruise the hemlock in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep it in a cool place.*

The preparation is set aside for seven days in order to allow all the albumins to be precipitated by the alcohol. They readily decompose, hence, having been filtered off, the juice is more likely to keep better. This slow precipitation of proteids is the method oftenest resorted to in dealing with albumin in physiological practice.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Cataplasma.	Juice.	1 in 15 nearly.	...
Unguentum.	"	2 in 1 nearly.	...
Vapor Coninæ.	"	4 in 13.	20 minims for inhalation.

CATAPLASMA CONII—Hemlock Poultice.—*Take of hemlock-juice,* 1 *fluid ounce; linseed meal,* 4 *ounces; boiling water,* 10 *fluid ounces. Evaporate the hemlock-juice to half its volume, add this to the linseed meal and water previously mixed, and stir them together.*

The substitution of Hemlock Juice for the leaves hitherto used gives a much more reliable poultice.

UNGUENTUM CONII—Ointment of Hemlock.—*Take of juice of hemlock,* 2 *fluid ounces; hydrous wool fat,* $\frac{3}{4}$ *ounce; boric acid, in fine powder,* 10 *grains. Evaporate the juice to* 2 *fluid drachms at a temperature not exceeding* 140° F. (60° C.); *add the boric acid and the hydrous wool fat, and mix thoroughly.*

The juice is evaporated under 100° C. to remove the alcohol, because if the heat be maintained at this amount for any length of time the active principle is volatilised. Boric acid is added to prevent decomposition, but the quantity used is too small to effect this. The introduction of this ointment into the Pharmacopœia in 1890 is a revival of the ointment of the Dublin College (differently prepared).

VAPOR CONINÆ—Inhalation of Conine.

Preparation.—*Take of juice of hemlock,* $\frac{1}{2}$ *fluid ounce; solution of potash,* 1 *fluid drachm; distilled water,* 1 *fluid ounce. Mix. Put* 20 *minims of the mixture on a sponge, in a suitable apparatus, so that the vapour of hot water passing over it may be inhaled.*

It is to be noted that this is called Inhalation of Conine—not *Inhalation of Conium,* for the caustic setting free the active principle it is really a solution of *Conine.*

Conii Fructus—*Hemlock Fruit.*—The fruit of *Conium macula-*

tum, Linn., gathered when fully developed, but while still green, and carefully dried.

Characters and Test.—About $\frac{1}{8}$ inch long, broadly ovoid, somewhat compressed laterally, and crowned by the depressed stylopod; dull greenish-grey. As met with in commerce, it consists usually of the separated mericarps, each of which presents five prominent more or less crenated ridges, with the furrows smooth, and without evident vittæ.[1] Reduced to powder, and rubbed with solution of potash, it gives out a very strong and disagreeable odour.[2]

[1] It thus differs from Caraway Fruit. [2] Sets free the Conine, neutralising the malic acid (or so-called coniïc acid).

Active Principles.—Fruit.—The cells of the endocarp are loaded with a brown liquid, consisting chiefly of an *Essential Oil* (non-poisonous) and *Conine, Conia, Cicutine* or *Conicine*, C_8H_{14},N.H., existing in the plant in combination with an acid, said by some to be malic, although Peschier gives it the name *Coniïc Acid.* The percentage of *Conine* varies from 0·2 to 0·8 per cent. In addition the *fruit* contains *sugar, albumin, gum, Conhydrine*, and *Methyl-conine.*

Preparation of Conine.—The best method is to exhaust the ground-fruit in *vacuo* with Acetic Acid, evaporate to a syrupy consistence, add Magnesia, and extract with Ether, distilling off the latter.

Conine has been prepared synthetically as follows:—*a-allyl-pyridine* (from *a-picoline* and *paraldehyde*), on reduction with *Sodium* in alcohol, gives *a-propyl-pyridine-hexahydride;* this *a-propyl-piperidine* is combined with *tartaric acid*, and from the resulting-product a dextro- and lævo-base are separated, the former of which is identical with natural *Conine* (although Hanbury and Flückiger state that synthetical *Conine* is optically indifferent, but it can now be separated into a right- and left-handed portion). *Conine* is a colourless liquid, having the odour of *hemlock*, and boiling at 167° to 168° C. It dissolves 25 per cent. of water, which it separates on warming, and becomes turbid in consequence. It is soluble in 90 parts of water. It turns a ray of light to the left (Richter); to the right (Hanbury and Flückiger). It is strongly alkaline. Conine may be recognised by its peculiar odour, by being liquid at ordinary temperatures, by its volatility, by its alkaline reaction with turmeric paper, and by giving white fumes of hydrochlorate of conine with the vapour of hydrochloric acid. *Conhydrine*, $C_8H_{17}NO$, another and less poisonous crystallisable base of conium, may be converted into *Conine* by abstraction of the elements of water. From *Conine* and *Conhydrine* a liquid non-poisonous hydrocarbon, *Conylene*, C_8H_{14}, has been separated. A third alkaloid *Paraconine*, having the composition $C_7H_{13}N$, has been found. Often in nature one hydrogen atom of *Conine* is replaced by *Methyl*, when it is called *Methyl-conine*, $C_8H_{14}NCH_3$. Commercial *Conine* frequently contains *Methyl-conine*. The *leaves* contain the substances mentioned under the fruit, but the yield of *Conine* is very much smaller proportionately, amounting to about 1 drachm from 100 pounds weight of fresh leaves. By destructive distillation they yield a poisonous *empyreumatic oil*.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Tinctura.	Finely divided fruit.	1 in 8.	20 to 60 minims.

TINCTURA CONII—TINCTURE OF HEMLOCK FRUIT.—Tinctura Conii Fructus.—*Take of hemlock fruit, bruised,* $2\frac{1}{2}$ *ounces; proof spirit, 1 pint. Prepared in the same way as Tincture of Aconite.*

CONINÆ HYDROBROMAS—HYDROBROMATE OF CONINE—(*not official*).—In colourless crystalline prisms, soluble in water 1 in 8.

Dose.—$\frac{1}{3}$ to 2 grains.

INJECTIO CONINÆ HYDROBROMATIS HYPODERMICA—HYPODERMIC INJECTION OF HYDROBROMATE OF CONINE—(*not official*).—1 in 20.

Dose.—1 to 3 minims by injection.

The addition of glycerine in the proportion of 3 drachms in each ounce (as suggested by Sharp (*P.J.*, 9/4/92) in the morphine preparation) to this and other hypodermic injections preserves them from decomposition, and keeps the piston of the syringe always in workable condition.

Therapeutics.—Conine, the active principle of hemlock, is a most powerful poison, and may be compared in activity with hydrocyanic acid, atropine, and aconitine. Locally, it is an intense irritant. The symptoms which conine induces when given in a dose sufficiently large to act decidedly on the system are, great muscular weakness and languor, with some disorder of vision, giddiness, dilatation of the pupils and ptosis. On trying to walk, he staggers or falls down, and the voice is hoarse from paralysis of the laryngeal muscles. In some these symptoms are preceded by burning pain in mouth, nausea, and vomiting, due to its local irritant action. The intellect is unaffected.

In still larger doses it causes essentially the same symptoms, which may terminate in death; and it appears that the more active an individual is in habit and constitution, the less susceptible is he to its action, and it leaves no bad effects after the symptoms pass off. In fatal cases, death takes place from paralysis of the respiratory muscles. In all, the paralysis of the voluntary muscles begins in the lower extremities, next the upper, and soon after the muscles of the trunk, and lastly, those of respiration are affected. Conine is, therefore, a motor depressant if pure, chiefly acting on the end-organs of the motor nerves; but according to some observers the spinal cord is first affected; this discrepancy is, however, explained by the researches of Professors Fraser and Crum Brown, who have shown that part of the alkaloid is sometimes converted into methyl-conine ($C_8H_{14}NCH_3$), and that methyl-conine acts principally on the cord, so that according to the proportion of these two substances present, the symptoms may vary somewhat in the order of their occurrence, but the result will be the same. However, when applied locally, it paralyses the ends of the sensory nerves. Conium, as a medicine, is purely sedative and antispasmodic. It is no true anodyne or hypnotic. It is of great benefit in many cases of undue nervous motor excitability. In order to produce beneficial results, hemlock must in all cases be given in doses sufficient to produce its physiological action. It is recommended by Dr J. Harley, in the undue excitement of the motor centres frequently accompanying the period of dentition in children; in epilepsy, provided the irritation is central and motor, and not peripheral or emotional, and especially if the disease is traceable to sexual abuse; in convulsive diseases of special muscles; in chorea; in paralysis agitans during its early stage; in nocturnal cramps; in cases of tetanus; in diseases due to spasmodic action of the vagus, such as spasm of the œsophagus, spasmodic contraction of the stomach and œsophagus, spasmodic cough, laryngismus stridulus, whooping-cough, spasmodic asthma; in organic or functional diseases of the cord, attended with excessive irritability of reflex function, as in certain cases of paraplegia, of concussion of the spine, and from the practice of self-abuse in early life; in acute mania, alone or with morphine; in inflammatory diseases of the eye; and to retard the progress as well as lessen the pain of cancer. Doubtless much of the discredit that has been attached to the drug has arisen in consequence of the employment of preparations destitute of the active principle, due to the method of preparing them and the volatility of the alkaloid, the official preparations, with the exception of the succus, being perfectly inert, and it should be given in much larger doses than usually employed, even to children from ʒss. to ℥ii. (HARLEY), or the alkaloid may be employed, dose $\frac{1}{10}$ to $\frac{1}{2}$ grain, but on account of its local irritant action whether given by the mouth or subcutaneously, it should first be neutralised by acetic, hydrochloric or sulphuric acid. In most cases some drooping of the eyelids with relaxation of the orbicularis muscle, giving them a swollen appearance, sluggish movements of the eyeballs, haziness of vision, with giddiness and weakness of the knees, or difficulty of swallowing or of speech, are the indications of moderate coneism (HARLEY), and of a proper effect. Conhydrine and dimethylconine are not so powerful in their action as conine.

The dose of conine is $\frac{1}{4}$ to 2 grains increased gradually.

Antidotes.—Give demulcents if seen at once ; then empty the stomach by stomach-tube or stimulant emetic. No chemical antidote ; hence our endeavour must be to maintain respiration by cold affusion, artificial respiration, galvanism to upper part of spine and chest walls, ammonia to the nostrils, and hypodermic injection of sulphate of atropine, and strychnine to stimulate the heart and respiratory centre.

Incompatibles.—Caustic alkalis and astringents.

Adulterations and Substitutions.—Plants of inferior quality, owing to having been kept too long. They may be known by the faintness or absence of odour developed on adding potash. *Æthusa cynapium*, or Fool's Parsley, is smaller than hemlock ; its primary umbel has no involucre, and its partial umbel has an involucel of 2 or 3 linear pendulous bracts, and when bruised has a leek-like odour. The ridges of its fruit, moreover, are not wavy or crenate as hemlock (and the fruit has vittæ), nor is its stem spotted. *Chærophyllum Anthriscus*, Common Beaded Parsley, and others of the parsnip family, have the lower leaves not unlike those of hemlock, but are pubescent or ciliated. The fruits, too, are linear-oblong. The leaves of *Achillea millefolium*, or Yarrow, have leaves like hemlock, but are hairy. *Myrrhis temulenta*, or Sweet Cicely, has a powerful aromatic odour. In doubtful cases, the potash test should be applied. Hemlock fruit is the only one possessing *no* vittæ or oil glands.

Æthusa cynapium—Fool's Parsley—Lesser Hemlock—(*not official*).—An indigenous plant.

Botany.—An annual herb. *Stem*, erect, smooth, $\frac{1}{2}$ to 2 feet high. *Leaves*, bright green, twice or thrice pinnate. *Umbels*, on long peduncles, without general involucres. Partial involucres of 2 or 3 long linear bracts turned all to one side. *Flowers* in July and August.

Habitat.—Indigenous on cultivated land.

Active Principles.—*Cynapine*, a crystallisable poisonous alkaloid, forming a crystalline sulphate. It is soluble in water and alcohol, but insoluble in ether. Beyond this nothing is known of its chemistry.

Therapeutics.—It has not been used in medicine, but from the severe symptoms which it occasionally produces there is evidence that its properties are well worth investigating. The symptoms of poisoning are :—"Heat in the mouth and throat, nausea, vomiting, headache, dilated pupil, convulsions, and lockjaw." The *antidotes* would be chloral hydrate and chloroform. Cases of fatal poisoning have occurred.

Oenanthe crocata—Water Dropwort—Dead Tongue—Water Lovage—Yellow Water Dropwort—(*not official*).—An indigenous plant growing in wet places.

Botany.—A large indigenous *perennial* herb, with tubercular, fusiform, fleshy, pale-yellow *roots*, over 3 inches long and ¾-inch thick, emitting a yellow *juice* when broken across. *Stem*, 4 or 5 feet high, dark green, smooth. *Leaves*, twice or thrice pinnate; the segments cuneate and deeply cut into 3 or 5 lobes. *Umbels*, on long terminal peduncles, with 15 to 20 rays, about 2 inches long.

Active Principles.—No complete analysis of the plant has been made, but a resinoid principle, *Oeanthin*, has been separated from *O. crocata* and O. *fistulosa*; and from *O. phellandrium*, a *volatile oil*, and a doubtful *volatile akaloid*, allied to *Conine*, are said to have been obtained.

Therapeutics.—Most contradictory statements as to the activity of the plant have been from time to time published, some saying it is poisonous, others that it is harmless. Christison says it is *not poisonous*, as it grows in the neighbourhood of Edinburgh. Differences of soil and time of gathering may account for these discrepancies. Authentic cases of poisoning with it have occurred, the symptoms being vomiting, giddiness, delirium, convulsions, and coma. The *antidotes* would be emetics, followed by demulcent drinks; and if convulsions, then chloroform by inhalation, or chloral hydrate by the mouth, if it can be borne. The roots chopped up, and made into decoction, have been used as a local application in ulcers and whitlows. An infusion of the leaves has also been applied locally in ichthyosis and psoriasis. Internally, infusion of the leaves (1 in 10) has been recommended in difficult menstruation. Recently the fruit of *O. phellandrium*, Lam., Phellandrium, or Five Leaved Water Hemlock, has been given in asthma, bronchitis, &c.

Dose.—Of the powdered fruit of phellandrium, 30 to 60 grains.

Cicuta virosa, Linn.—Cowbane—Water Hemlock—(*not official*).—An indigenous plant growing in marshy places.

Active Principles.—No complete analysis has been made, but is said to contain a *volatile alkaloid Cicutine* (not *Conine*); a *volatile oil*, like that of thyme; and an amorphous resin called *Cicutoxin.*

Therapeutics.—Christison says this plant is *not poisonous* as found around Edinburgh, and yet it is generally held to be one of the most poisonous of our umbelliferous plants. It is not used internally, but externally has been employed as an anodyne application to rheumatic joints.

Selinum palustra, Linn.—Peucedanum montanum, Lind.—Marsh Parsley—(*not official*).—An European plant whose root is dark brown in colour, and with an acrid pungent taste. It contains *gum, lignin, fixed oil, volatile oil, selinic acid,* and *a yellow colouring principle.* Used in Russia as a popular remedy in epilepsy; also in whooping-cough and bronchitis. The dose is 20 to 30 grains in powder, three times a day.

Sium nudiflorum—Water Parsnip.—A native of the United States—(*not official*), and **Sium latifolium**—Common Water Parsnip —(*not official*).—It is believed by some that they are both highly poisonous, while others think they are inert. They have been used as diuretics in the form of infusion of the leaves (1 in 10; dose, 2 to 4 fluid ounces).

Hydrocotyle asiatica, Linn.—Indian Pennywort—(*not official*). --Official in the I.P. *Habitat.*—The Cape, New Zealand, Chili, India. The leaves are the parts employed. The active principle is *Vellarine*, an oily fluid, with a strong odour and a bitter pungent taste. The dose of the powdered leaf is 10 grains, three times a day. It is reputed to be a diuretic and tonic alterative, and is used in skin disease in the form of poultices or ointment, and some years ago was lauded as a remedy for leprosy, and under the name of *Bevilacqua* was sold in the Mauritius as a specific for that disease.

Imperatoria obstruthium—Masterwort—(*not official*).—Has been found as a careless adulterant of aconite root. It is indigenous in the south of Europe. The root, which is the part used, has an odour like that of Angelica. It contains tasteless crystalline principles, *Imperatorin*, $C_{16}H_{16}O_4$, and *Obstruthin*, $C_{14}H_{17}O_3$, besides a *volatile oil*, and it also yields *Angelic Acid*, $C_5H_8O_2$. It is considered diuretic, diaphoretic, and emmenagogue, but is now seldom used.

Eryngium aquatica and **E. yuccæfolium**—Eryngo—Button Snake-root—Corn Snake-root—Rattlesnake's Master—(*not official*).

Habitat, dry or damp pine barrens of New Jersey and Winconsin, and also South Carolina. The root (the part used) in medicine has the following *characters:*—$\frac{1}{4}$ to $\frac{1}{2}$ inch long, with short branches. A transverse section shows a whitish central pith and several short wood wedges, separated from the bark by a brown cambium line. Externally it is brown. The odour is aromatic, and the taste sweet and aromatic, somewhat acrid. No analysis has been made, but probably the active principle is a *volatile oil*. Medically, the root is reputed to be diaphoretic, diuretic, and emetic, and has been used in the form of decoction (1 in 40, boiled down to half).

Dose.—1 fluid ounce.

Coriandrum sativum—Coriander—Coliander.

Botany.—Annual. *Stem*, erect, smooth, striated, 18 inches to 2 feet high. *Leaves*, bipinnate. *Flowers*, white, or with a reddish tinge. *Habitat*, south of Europe; met with wild, and also cultivated in Essex. *Flowers* in June, and fruit is ripe in August.

CORIANDRI FRUCTUS—*Coriander Fruit.*—The dried ripe fruit of *Coriandrum sativum*, Linn.

Characters.—Nearly globular, and consisting of two closely-united hemispherical mericarps crowned by the calyx-teeth and stylopod, about $\frac{1}{5}$-inch in diameter, brownish-yellow, hard, faintly ribbed, with both primary[1] and secondary ridges, the two mericarps enclosing a lenticular cavity, and each furnished on its commissural surface with two brown vittæ. It has an agreeable, mild, aromatic taste, and, when bruised, a pleasant odour. (When unripe, Coriander has a disagreeable odour, like that of bugs, hence the name from the Greek word *koris*, a bug. The nature of this disagreeable body has not been ascertained.)

[1] The primary ridges are wavy.

Active Principles.—Yields about 1 per cent. of *volatile oil*, containing an *oxygenated hydrocarbon*, isomeric with *Borneol*, $C_{10}H_{18}O$. When treated with phosphoric anhydride to remove the elements of water, the oil is converted into an *offensive smelling body*, $C_{10}H_{16}$. The oil has the specific gravity 0·860 to 0·877, and is soluble in 2 in 1 of rectified spirit and 1 in 75 of proof spirit; 13 to 14 per cent. *fixed oil* (stearin and oleïn); *tannin*, *gum*, and *sugar*. Yields 5·21 per cent. of *ash* when incinerated.

Official Preparation.

Name.	Part Used.	Dose.
Oleum.	Bruised fruit.	1 to 4 minims.

Also contained in *Confectio Sennæ* (1 in 25), *Syrupus Rhei* (1 in 15), *Tinctura Rhei* (1 in 80), and *Tinctura Sennæ* (1 in 40).

OLEUM CORIANDRI—OIL OF CORIANDER.—The oil distilled in Britain from Coriander fruit.

Characters.—Pale yellow or colourless, having the odour of the fruit, and a mild aromatic taste.

Dose.—1 to 4 minims.

Employed to flavour *Syrupus Sennæ.*

Therapeutics.—Coriander is used only as a corrective and flavouring adjunct to other remedies, and is especially useful in disguising the taste and odour of senna. It is used by the distillers of gin.

Adulterations.—The *fruit* is not systematically adulterated. The *Oil* is often adulterated with *Essential Oil of Orange* (Oleum Aurantii Corticis), to be detected by heating, when the orange odour is given off. The specific gravity is also to some extent a means of detection. Alcohol as an adulterant is detected by the colour which it gives when shaken up with dry fuchsine.

Daucus carota, Linn.—The Carrot—(*not official*).—An indigenous plant whose fruit was official in the London and Dublin Pharmacopœias, and the root in all three Pharmacopœias. The fruit is official in the U.S.P.

Active Principles.—The fruit contains a *volatile oil.* The roots contain *Carotin*, $C_{18}H_{24}O$; *Hydrocarotin*, $C_{18}H_{30}O$; a *volatile oil, sugar, pectin*, and *nitrogenous matter. Carotin* is red, and is believed to be formed by oxidation of *Hydrocarotin*, a colourless body.

Therapeutics.—The fruit, like similar umbelliferæ, is aromatic, carminative, and diuretic. The boiled bruised root is a domestic application to boils and whitlows. The powdered fruit is given in 30 to 60-grain doses, and an infusion (1 to 20 of bruised fruit) is given in 6-ounce doses as a diuretic.

Archangelica officinalis, Hoffm.—Angelica.

Indigenous plants growing in marshes (*not official*).

Active Principles. — *Angelic Acid*, $C_5H_8O_2$; *Valerianic Acid*, $HC_5H_9O_2$; *terpenes* (3); *crystalline and amorphous resin; sugar; tannin; albumin; pectic acid; and malic acid*, &c.

Therapeutics.—Both root and fruit are used, and are aromatic, tonic, and diaphoretic. They have been recommended in chronic bronchitis. The young shoots are made into a sweetmeat with sugar, and used as a stomachic. The root and fruit are used in the manufacture of gin and so-called "bitters."

Dose of the root—10 to 30 grains made into infusion.

Cuminum Cyminum, Linn.—Cumin or Cummin.

The plant of the Old and New Testaments. Indigenous to Egypt; cultivated in Southern Italy (*not official*).

Character of the Fruit.—Called Cumin Seeds. Brownish or greyish-yellow in colour, strong aromatic odour and taste, not unlike caraway. A quarter of an inch long, oval-oblong, slightly narrowed at both ends, little laterally compressed crowned by the persistent calyx-teeth; mericarps not readily separating at the concave joint, the primary ridges are slightly developed, the secondary one more prominent, and both or only the latter are hairy; the oil-cells are small, solitary, and beneath the secondary ridges, with two in the joint. The seeds are exported from Sicily, Morocco, Malta, Bombay, and Calcutta. They are used as a condiment more especially in India, and are contained in curry powders.

Active Principles.—The fruits contain about 8 per cent. of a *fatty oil*, 0·25 per cent. of a *volatile oil, resin, and gum.* The *essential oil* consists of several *hydrocarbons—one* having the composition $C_{10}H_{16}$, another *Cymol* or *Cymene*, $C_{10}H_{14}$, having a lemon-like odour; and an *oxygenated body, Cuminol* or *Cuminic Aldehyde*, $C_{10}H_{12}O$, which yields with *nitric acid* or *hydrogen peroxide, Cuminic Acid*, $C_{10}H_{12}O_2$.

Therapeutics.—Aromatic and carminative.

Dose of the powdered fruit, 10 to 30 grains. A plaster—Emplastrum Cumini—was once official in the London Pharmacopœia, and is occasionally used in domestic medicine as a stimulating application.

Petroselinum sativum, Hoffm.—(Apium Petroselinum, Linn.)—Parsley.

Indigenous (*not official*).

Active Principles.—Volatile oil and *Apiïn*, $C_{24}H_{28}O_{13}$, a *glucoside* (probably), are obtained from the root. The fruit contains: a *fixed oil, volatile oil*, and an oily body, *Apiol*, soluble in alcohol, ether, chloroform, and glacial acetic acid. Both volatile oils are made up of a *hydrocarbon*, $C_{10}H_{16}$, and a *stearoptene* (or Parsley Camphor), $C_{12}H_{14}O_4$.

Therapeutics.—Recommended in amenorrhœa and dysmenorrhœa, but without reason.

Dose of the powdered seeds, 10 to 15 grains; of Apiol, 5 to 6 minims in capsules.

Apium graveolens—Celery.

Indigenous (*not official*).

Active Principles.—Volatile Oil; Apiïn and *Apiol*, &c. (See Parsley.)

Therapeutics.—Has been given in the form of decoction (from the root) in chronic rheumatism. Some believe it to be stimulant to the nervous system.

Fœniculum capillaceum—Fennel—Sweet Fennel.

Botany.—Perennial. *Stem*, 2 to 4 feet high, smooth, bright green, solid, much branched. *Leaves*, stalked, *petiole*, very long, dilated into an open sheath. *Umbels*, large, long-stalked without involucres. *Flowers*, 15 to 20 in an umbel. *Calyx-teeth*, quite absent. *Petals*, roundish, entire, bright yellow, none radiant. *Stamens*, bright yellow. *Disk*, large and cushiony. *Styles*, very short. It *flowers* in July and August. *Habitat*, not indigenous; cultivated.

Fennel is a variable plant in every way. This is due to the fact that it has been so long cultivated in many countries that it must present different appearances in different soils and under different conditions. The large number of specific names applied to Fennel shows that it must have been a source of trouble to the botanist; but it is now generally agreed that they are only varieties of the same species. The four kinds found in commerce are :—

1. Sweet or Roman Fennel, cultivated in the south of France.

2. German or Saxon Fennel, cultivated in Saxony. These answer to the Pharmacopœial description.

3. Wild or Bitter Fennel. Grows wild in the south of France. The fruit is broader and smaller than the German kind. The taste is *bitter*.

4. Indian Fennel. Fruit shorter and straighter than Roman Fennel.

Fœniculi Fructus—*Fennel Fruit.*—The dried fruit of cultivated plants of *Fœniculum capillaceum*, Gilib. (*Fœniculum vulgare*, Gaert), Syn. *F. dulce*, D.C. ; *F. officinale*, All. ; *F. sativum*, Bertot.; *F. panmorium*, D.C. ; *Meum Fœniculum*, Spreng. ; *Anethum Fœniculum*, Linn.

Characters.—From $\frac{1}{5}$ to about $\frac{2}{5}$ inch long, oblong, or ovoid-oblong, more or less curved, capped by a conspicuous stylopod and two styles, smooth, greenish-brown or brown ; odour, aromatic ; taste, aromatic, sweet, and agreeable. The fruit is readily separated into its two mericarps, each of which has five prominent ridges, and the lateral are the broadest, and four vittæ (or oil glands) in the grooves, and two on the commissure.

Active Principles.—Contains *gum*, *resin*, *tannin*, *albumin*, *sugar*, *fixed oil*, *Volatile Oil.* The latter is the most important, and on it rather than on the sugar is said to depend the bitterness or sweetness of the plant. It consists of *Anethol* (or *Anise-camphor*), $C_6H_4OCH_3CH.CH.CH_3$, and a variable proportion of an *Oil* isomeric with *oil of turpentine*, $C_{10}H_{16}$.

Anethol may be obtained in crystalline or liquid form. The former is deposited at low temperatures, forming white glistening scales, melting at 21° C. and boiling at 232° C.; the latter may be obtained by collecting the portion of the crude oil passing over at 225° C. It remains fluid at even $-10°$ C. By long keeping crystalline *Anethol* becomes fluid, and cannot again be crystallised. *Anethol* is the *Methyl-ether* of *Anol*, and has been prepared synthetically from Para-methoxyphenyl-crotonic acid. *Oil of fennel* has the specific gravity 0·997 to 0·999, deviates a ray of light to the right, and is pale yellow in colour. The yield of *oil* from the fruit is about 3·5 per cent.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Aqua.	Bruised fruit.	1 pound to 1 gallon.	1 to 2 fluid ounces.

Also contained in *Pulvis Glycyrrhizæ Compositus* (1 in 12).

AQUA FŒNICULI—FENNEL WATER.—*Take of fennel fruit, bruised*, 1 *pound; water*, 2 *gallons. Distil one gallon.*

Therapeutics.—Fennel acts as a carminative, and is occasionally given in the flatulent colic of children, or as a vehicle for other medicines.

Adulterations or Substitutions.—Wild or Bitter Fennel, smaller and broader than the Sweet, and the ridges are less prominent, and the taste is bitter and spicy. Fennel deprived of its Oil has been used to adulterate the drug, and may be known by the faintness or absence of the taste and odour.

Peucedanum graveolens—Dill.

Botany.—Annual. *Root*, long and tapering. *Stem*, 18 inches to 2 feet high, smooth, finely striated, and simply branched. *Flowers*, yellow; umbels long, stalked. *Habitat*, south of Europe, Egypt, &c.; cultivated in Britain.

ANETHI FRUCTUS—*Dill Fruit.*—The dried ripe fruit of *Peucedanum graveolens*, Hiern. (*Anethum graveolens*, Linn.; *Pastinaca Anethum*, Spreng.).

Characters.—Broadly oval, about $\frac{1}{6}$-inch long, flat, and surrounded by a broad membranous border.[1] It has a brown colour, the membranous border being paler. The half fruits or mericarps are usually distinct in the fruits of commerce. Odour and taste agreeably aromatic.

[1] These membranous borders or wings are a distinguishing feature of dill fruit.

Indian dill fruit is longer, narrower, and lighter in colour. It is said to be produced by *A. Lowa*, Roxb., but it is really only a variety of *P. graveolens.*

Active Principles.—Besides the unimportant substances—*sugar, gum, tannin, and some fixed oil*—the plant contains the important *Volatile Oil* to be described later.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Bruised fruit.	1 pound to 1 gallon.	1 to 2 fl. ounces.
Oleum.	" "	Yields about 4 per cent.	1 to 4 minims.

AQUA ANETHI—Dill Water.—*Take of dill fruit, bruised, 1 pound; water, 2 gallons. Distil 1 gallon.*

OLEUM ANETHI—Oil of Dill.—The oil distilled in Britain from dill fruit.

Characters of the Oil.—Colour pale yellow, odour pungent, taste acrid, sweetish.

Dill fruit yields about 4 per cent. of *Volatile Oil*, having a specific gravity of 0·850 to 0·890. It is readily soluble in alcohol and ether. Its chief constituent is a Hydrocarbon, isomeric with oil of turpentine, and named *Anethane*, $C_{10}H_{16}$, which has a specific gravity of 0·846, boils at 172° C., and is dextrogyre. In addition it yields *Carvol* or *Carvacrol*, $C_{10}H_{14}O$ (see Caraway). Like anise and fennel-oils, dill oil yields on oxidation with HNO_3, *Anisic Aldehyde*, $C_6H_4(O.CH_3).CHO$.

Therapeutics.—Dill acts as an aromatic stimulant, and is employed as a corrective and flavouring adjunct or vehicle to other remedies, and in the flatulent colic of children (gripes), in one or two teaspoonful doses of the water.

Adulterations.—Dill fruit is not generally adulterated, but occasionally earthy impurities are found and easily detected by placing a handful of the fruit on the surface of a glass of water when the impurities sink to the bottom. Hemlock fruit has also been found, and is readily known by the prominent ridges and absence of oil glands (vittæ). The oil is adulterated with alcohol, wax, spermaceti (the two latter are insoluble in alcohol), camphor (it gives with caustic potash solution a camphor odour), and the stearoptene of fennel-oil, which gives with caustic potash, the fennel odour.

Pimpinella anisum—Anise—Aniseed.

ANISI FRUCTUS—*Anise Fruit.*—The dried fruit of *Pimpinella anisum*, Linn.; Berg und Schmidt, t. 18 d.

Characters.—Anise fruits, with the exception of the Russian variety, which is shorter, average about ⅕-inch long. They are ovoid-oblong in form, of a greyish-brown colour, and their whole surface is covered with short hairs.[1] Their two constituent mericarps are united and attached to a common stalk,[2] and each mericarp is traversed by five pale, slender, entire ridges, and its transverse section exhibits about fifteen vittæ.[3] They have an agreeable aromatic odour, and a sweetish spicy taste.

[1] This marks them out from Conium, which they resemble. [2] Usually no vittæ on commissure. [3] It has several vittæ in each groove. Pimpinella-Spanish or Alicante Anise is the best, the German coming next. The yield of *volatile oil* from Pimpinella Anise is from 2·5 to 3 per cent.

Illicium anisatum.—Belonging to the order *Magnoliaceæ*, is one of the sources of oil of anise (see page 173).

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Bruised Fruit.	1 pound to 1 gallon.	1 to 2 ounces.
Oleum.	"	... ...	1 to 4 minims.

AQUA ANISI—ANISE WATER.—*Take of anise fruit, bruised,* 1 *pound; water,* 2 *gallons. Distil* 1 *gallon.*

OLEUM ANISI—OIL OF ANISE.—The oil distilled in Britain from anise fruit; or in China from star-anise fruit.

Characters.—Colourless or very pale yellow, with the odour of the fruit and an aromatic sweetish taste. The ordinary oil of anise congeals at temperatures between 50° and 60° F. (10° to 15·5° C.) and may remain solid at 62° or 63° F. (16·7° to 17·2° C.). Oil of star-anise only becomes solid at a few degrees above the freezing point of water.[1]

[1] Umney (*P.J.*, 16/2/89) states that Oil of Star-Anise (true) solidifies between 49° and 56° F.

The *Volatile Oil* varies in specific gravity from 0·977 to 0·983. It consists almost entirely of *Anethol*, already described under Fennel. In addition it contains a neutral hydrocarbon in very small amount. This is an isomer of *oil of turpentine*, $C_{10}H_{16}$. The rotatory power of Anise is much inferior to that of Fennel, due to the fact that *Anethol* is a larger constituent of Anise than it is of oil of fennel.

For chemical tests and solubilities see under *Adulterations*.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Essentia Anisi.	Volatile Oil.	1 to 5.	10 to 20 minims.

Also contained in *Tinctura Camphoræ Composita* (1 in 320), and *Tinctura Opii Ammoniata* (1 in 160).

ESSENTIA ANISI—Essence of Anise.—*Take of oil of anise, 1 fluid ounce; rectified spirit, 4 fluid ounces. Mix.*

The preparation of this essence gives a ready means of testing the purity of the oil used. We have frequently seen it form a white mixture with the highest priced oils obtained from the best sources.

TINCTURA ANISI—Tincture of Anise—(*not official*).—(1 in 5 of rectified spirit).

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

ACIDUM ANISICUM—Anisic Acid, $C_8H_8O_3$—(*not official*).—*Obtained by oxidising anethol by means of HNO_3. It is paramethoxybenzoic acid.*

Dose.—5 to 20 grains.

SODII ANISATUM—Sodium Anisate—(*not official*).—*It is obtained by heating anisic acid with alcoholic caustic soda, when sodium anisate and anisic alcohol result.*

Dose.—5 to 20 grains.

Therapeutics.—Oil of anise acts as an aromatic, carminative, and stimulant. It is used as a corrective and flavouring adjunct to other medicines, and in the flatulent colic of children, in one or two teaspoonful doses of the anise water. It is employed also in confectionery. It is, all in all, the most agreeable of the carminatives, although many object to its flavour. Anisic acid and sodium anisate possess antipyretic properties. They have also been used in solution as antiseptics in the same strength as salicylic acid.

Adulterations or Substitutions.—The fruit is sometimes found mixed with Hemlock fruit. This is easily detected by noting the absence of oil glands in the latter, and by the fact that, when rubbed with caustic potash solution, the characteristic hemlock odour is developed. This latter test is the only one applicable when we have the powdered drug to deal with. Large admixtures of sand and earthy matter are occasionally found—with the object of materially increasing the weight. The Oil is adulterated with wax, spermaceti, and alcohol. Wax and spermaceti are detected by their insolubility in alcohol. Camphor by the smell. Alcohol by treatment with fuchsine, which it dissolves and forms a bright crimson solution. Both oils are soluble in all proportions in absolute alcohol, and in 1 to 200 of proof spirit, and in 1 to 3 or 4 of rectified spirit. With a saturated solution of HCl gas in absolute alcohol, Pimpinella Oil gives a manganese pink colour, while Star-Anise Oil gives a brown coloration. This is known as Eykmann's test, but it is not reliable.

The following Table will be found useful in comparing the Umbelliferous Fruits which often puzzle the student :—

Fruit.	Colour.	Shape.	Taste.	Odour.	Vittæ.	Surface.
DILL.	Brown.	Broadly oval.	Aromatic.	Aromatic.	1 in each groove ; 2 on commissure.	Smooth winged.
ANISE.	Grey-brown.	Ovoid, oblong, prismatic.	Spicy.	Aromatic.	15 in transverse section.	Hairy.
HEMLOCK.	Greenish-grey.	Broadly ovoid.	Spicy.	Mousey.	None.	Cremated ridges and smooth furrows.
CORIANDER.	Buff.	Globular.	Aromatic.	Aromatic.	None on surface ; 2 on each commissure.	Wavy primary and straight secondary ridges.
CARAWAY.	Brown.	Spindled, tapering.	Spicy aromatic.	Aromatic.	1 large distinguishing in each groove.	Pale ridges and brown furrows.
FENNEL.	Greenish-brown.	Oblong.	Aromatic sweet.	Aromatic.	4 in grooves and 2 on commissure.	Arched, 5 prominent ridges.

Dorema Ammoniacum—Ammoniacum—*Syn.* Diserneston gummiferum.

AMMONIACUM—*Ammoniacum.*—A gum resinous exudation from the stem (after being punctured by beetles) of *Dorema ammoniacum*, Don.

Collection, &c.—The stem of the plant yields a milky juice, which as it flows out hardens into tears. The puncturing is usually done by beetles. It is gathered about the end of July.

Characters and Tests.—In roundish tears, varying in size from that of a coriander fruit to that of a cherry, or even larger, or in nodular masses of agglutinated tears of various sizes and forms; pale yellowish-brown externally when recent, but darken by keeping to cinnamon-brown; milky-white and opaque internally; hard and brittle when cold, and breaking with a dull waxy fracture, but readily softening with heat. It has a faint, peculiar non-alliaceous odour [1] and bitter acrid taste. When triturated with water, it forms a nearly white emulsion. It is coloured yellow by caustic potash,[2] and a solution of chlorinated soda gives a bright orange hue.[3]

[1] This distinguishes it from other gum resins of the order, especially African Ammoniacum. [2] Owing to the development of colouring matter. [3] This reaction does not occur with African Ammoniacum.

Dose.—10 to 20 grains.

Active Principles.—Ammoniacum has a specific gravity of 1·207, and is a mixture of *volatile oil* with *resin and gum.* The *volatile oil* has the specific gravity 0·891, and the boiling point is between 250° and 299° C. It has been stated that the oil contains no sulphur, others say it does, and the balance of evidence would appear to be in favour of the former. The *mucilaginous* matter consists of a *soluble* and an *insoluble gum.* Fused with caustic potash it yields *Resorcin*, $C_6H_4(OH)_2$, and *protocatechnic acid*, $C_6H_3(OH)_2.CO_2H$). The action of HNO_3 produces *Trinitro-resorcinol* (*Styphnic* or *Oxypicric* Acid, $C_6H(NO_2)_3(OH)_2$). Unlike the other gum resins of the order, ammoniacum yields no *Umbelliferon* (*Oxycoumarin*), ($C_9H_6O_3$).

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Emplastrum Ammoniaci cum Hydrargyro.	Gum-resin.	12 in 15.	...
Mistura Ammoniaci.	”	13½ grains in 1 ounce.	½ to 1 fluid ounce.

Contained also in *Emplastrum Galbani* (1 in 11), *Pilula Scillæ Composita* (1 in $6\frac{1}{4}$), *Pilula Ipecacuanhæ cum Scilla* (1 in 7).

EMPLASTRUM AMMONIACI CUM HYDRARGYRO—Ammoniacum and Mercury Plaster.—Preparation.—*Take of ammoniacum, 12 ounces; mercury, 3 ounces; olive oil, 56 grains; sublimed sulphur, 8 grains. Heat the oil, and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury, until globules are no longer visible; and, lastly, add the ammoniacum previously liquefied, mixing the whole carefully.*

The sulphur is added for the purpose of sub-dividing the mercury.

MISTURA AMMONIACI—Ammoniacum Mixture.—Preparation.—*Take of ammoniacum, in coarse powder, $\frac{1}{4}$ ounce; distilled water, 8 fluid ounces. Triturate the ammoniacum with the water, gradually added, until the mixture assumes a milky appearance, then strain through muslin.*

The water dissolves the gum, and this suspends the resin and so forms an emulsion.

MISTURA AMMONIACI COMPOSITA—Compound Mixture of Ammoniacum—(*not official*).—*Compound tincture of camphor,* 30 *minims; oxymel of squills,* 30 minims; *ammoniacum mixture to* 1 *ounce for a dose.*

Therapeutics.—Ammoniacum acts like the other fetid gum-resins, but much less powerfully than asafœtida or galbanum, probably because it contains less volatile oil. It is not much employed internally, but may be given in certain chronic pulmonary affections, such as the catarrh and asthmatic affections of old people. Its chief use is in the form of the plaster, as a stimulant application to chronic affections of the joints, and glandular enlargement. The plaster sometimes causes considerable local irritation, followed occasionally by a papular eruption, although many cases of the eruptions described have been due to the mercury rather than the ammoniacum.

Adulterations and Substitutions.—African or Morocco Ammoniacum from *Ferula tingitana.* It is in large, compact dark masses formed of agglutinated tears having a whitish, pale-greenish, or fawn colour, and it has not the odour of true Ammoniacum, and chlorinated soda solution has no effect upon it, and fused with caustic potash it gives resorcin, and an acid not obtained from true Ammoniacum; and further, it yields Umbelliferon (Ammoniacum does not). Lump Ammoniacum, in agglutinated large masses, and obtained from the mature plant, is easily detected. It has the same properties as the tears, but is mixed with extraneous matter, such as the mature pericarps.

Ferula Sumbul—Sumbul—Musk Root.

SUMBUL RADIX—*Sumbul Root.*—The dried transverse sections of the root of *Ferula Sumbul*, Hook. fil (*Euryangium Sumbul*, Kauffmann).

Characters.—Varying much in size, but usually from about one inch to three inches in diameter, and from three quarters of an inch to more than an inch in thickness. The pieces are covered on the outer surface with a dusky-brown papery transversely-wrinkled bark, and are sometimes beset with short bristly fibres; internally they are spongy, coarsely fibrous, dry farinaceous, and dirty yellowish-brown, mottled with whitish patches and spots of exuded gum. Odour, strong, musk-like; taste, bitter, aromatic.

All the Sumbul used in this country is said to be imported from Russia. Indeed, the drug was first introduced to the profession in Russia in 1835, from which place a knowledge of it spread to Germany and thence to Great Britain. Indian Sumbul has a less powerful musky odour than the Russian variety. Sumbul-root is interesting from a botanical point of view, on account of the irregularity of its woody and medullary rays, and the looseness in structure of its cortical portion. The structure of the root is peculiar also in its arrangement in that it forms independent secondary zones of cambium (it is usually a single layer) with fibro-vascular bundles within the original cambium. This peculiarity is also seen in *Convolvulus Scammonia*, *Ipomœa Turpethum*, and Myrrhis odorata.

Active Principles.—The most important constituents of Sumbul are a *Resin*, of which it contains about 9 per cent., and a *bluish volatile oil* about $\frac{1}{3}$ per cent. The *Resin* has a musky smell, but as this odour is not fully developed till water has been added, the odoriferous principle would appear to exist in the form of a ferment (see Amygdalin). It dissolves in strong H_2SO_4, forming a violet-brown solution. Caustic potash solution converts it into *Sumbulamic Acid* and *Sumbolic* or *Sumbulolic Acid*. The former has been obtained in a crystalline form, smells of musk, but has not been investigated; the latter is identical with *angelic acid*, $C_4H_7CO_2H$, and from the above alkaline solution *potassium angelate*, $C_4H_7CO_2K$, can be obtained. A little *valerianic acid*, $HC_5H_9O_2$, is also present. Another substance, *Sumbulin*, forming salts of a crystalline nature—with acids—has also been described. By dry distillation Sumbul yields *Umbelliferon* (see Asafœtida).

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Tinctura.	No. 40 powder.	1 in 8.	10 to 30 minims.

TINCTURA SUMBUL—TINCTURE OF SUMBUL.—*Take of sumbul root, in* No. 40 *powder*, $2\frac{1}{2}$ *ounces; rectified spirit*, 1 *pint.* Prepared in the same way as tincture of aconite.

Rectified spirit is now employed instead of proof spirit. The latter did not exhaust the root sufficiently. A definite state of subdivision has also been prescribed.

Therapeutics.—It has been employed as a nervine stimulant, and appears to be allied to valerian in its action. It is also used for the sake of its antispasmodic and composing qualities. It has been given in hysteria, chorea, epilepsy, delirium tremens, low typhoid fevers, chronic pulmonary affections, cholera, &c. On account of the resin it contains, it has also been used in gleet, gonorrhœa, and other urethral discharges. It has never found favour in this country, and is now perhaps less used than ever.

Adulterations.—The root of *Dorema Ammoniacum* used as incense among the Parsees, and called by them Boi, and known to Europeans as Bombay Sumbul, has been used as an adulterant. Its structure, if the latter be examined carefully, will be found to differ much from Sumbul root, and it has in addition a yellow colour, and has *no* musky odour.

Ferula Narthex—Gummi-resina Asafœtida vel Assafœtida—Asafœtida—Thibetan Asafœtida.

Ferula Scorodosma—Persian Asafœtida.

ASAFŒTIDA—*Asafœtida.*—A gum-resin obtained by incision from the living root of (1) *Ferula Narthex*, Boiss. (*Narthex Asafœtida*, Falconer); (2) of *Ferula Scorodosma*, Benth. and Hook. fil; and (3) probably other species. The greater quantity of the Asafœtida of commerce is derived from *Ferula Scorodosma*, not from *F. Narthex.*

Aitchison believes that the plant dies after flowering, but that Ammoniacum and Galbanum produce annual flowering stems from a perennial root. The following Asafœtida-yielding plants are fully described, and their distinctive characters summarised, by Holmes in the *Pharm. Journ.*, 1888–89, pp. 21, 41, 364:—*Ferula fœtida*, Regel. (*F. scorodosma*, Bentl. and Trim.; *Scorodosma fœtidum*, Bunge); *F. Narthex*, Boiss.; *F. fœtidissima*, Regel and Schmab;

F. alliacea, Boiss.; *F. rubricaulis*, Boiss.; *F. teterrima*, Karel. et Kirib.; *F. persica*, Willd. Regel remarks, *F. fœtidissima* not only secretes more Asafœtida than any of the others, but that the odour is the most penetrating. All these plants are natives of Persia, Afghanistan, and neighbouring regions, and the drug is imported (by way of Bushire and down the Indus) from India. Bellew states that a very fine variety is procured from the leaf-bud in the centre of the roothead, but is never exported. This is the Kandahari-Hing of the Indian bazaars. It occurs in moist, flakey pieces and tears, yielding a reddish-yellow oil on pressure, and mostly mixed with remains of the leaf-buds. In some of its chemical reactions it is said to differ from ordinary Asafœtida.

Collection, &c.—In June the root-stock is first laid bare to the depth of a couple of inches, those plants only which have not reached their flowering stage being selected. A slice is then taken from the top of the root-stock, which is immediately covered with a sort of dome of twigs and clay with an opening towards the north, so that the sun cannot get at the exposed root. In about five weeks a thick gummy, not milky, reddish substance is found upon the exposed surface of the root in more or less irregular lumps, is scraped off with a piece of iron hoop or removed by a slice of the root, and at once placed in a leather bag and conveyed to Herat, where it is adulterated with a red clay before being sent into commerce.

Characters and Tests.—Rarely in tears; usually in irregular masses, varying in consistence and size, and composed of tears agglutinated together by darker coloured and softer material. When broken or cut, the exposed surface has an amygdaloid appearance, the fractured tears being opaque and milk-white at first, but gradually changing to purplish-pink or reddish-pink, and finally to dull yellowish-brown. Taste, bitter, acrid, and alliaceous; odour, strong, alliaceous,[1] and persistent. When triturated with water, it forms a white emulsion. The freshly-fractured surface of a tear, when touched with nitric acid, assumes for a short time a fine green colour.[2] It should yield not more than 10 per cent. of ash.[3] 50 to 60 per cent. should be soluble in rectified spirit.[3]

Dose.—5 to 20 grains.

[1] This distinguishes it from Ammoniacum. [2] Due to the presence of one of the oxidation products of its resin (caffeïc acid?). [3] Show that it is not adulterated with twigs, earthy matters, &c. The specific gravity is about 1·327.

Active Principles.—*Resin*, *gum*, and *Volatile Oil* in variable proportions. The powerful alliaceous odour is due to the volatile oil of which from 3 to 10 per cent. is obtained by distillation with water. Hlasiwetz considers it a mixture in variable proportions of *sulphides* and *bisulphides* of a *compound radicle*, C_6H_{11}. An *allyl persulphide*, obtained by sublimation on heating *Ol. Sinapis* with potassium persulphide, is said by Werthium to have an extremely intense Asafœtida odour. Dr Semmiber, in an exhaustive paper (*Pharm. Journ.*, 1890–91, p. 760), describes the crude oil as varying only slightly in its composition, dark brown in colour, and lævogyre. It does not distil at ordinary pressure, but at 9 mm. pressure it boils at from 140° to 165° C. Among the constituents separated were four *sulphuretted compounds*, *one* of which, $C_7H_{14}S_2$, constitutes about 45 per cent. of the crude oil; *another*, $C_{11}H_{20}S_2$, about 20 per cent. The other two, present only in small quantity, are represented by the formulæ $C_8H_{16}S_2$ and $C_{10}H_{18}S_2$. In addition a *terpene*, $C_{10}H_{16}$, probably identical with *pinene*, was found, and a *blue* oxidised constituent similar to that occurring in some other essential oils. The *resin*, varying from 55 to 65 per cent., contains a little *ferulic acid*, $C_{10}H_{10}O_4(C_6H_3.OCH_3.OH.CH.CH.COOH.)$, obtained by precipitating the alcoholic tincture with lead acetate and decomposing the resulting lead salt with H_2S. It crystallises from boiling water in long trimetric four-sided needles. The *Resin*, fused with caustic potash, yields *resorcin* and *protocatechnic acid*, and, by dry distillation, oils of a green, blue, violet, or red tint, besides about 0·25 per cent. of *Umbelliferon*, $C_9H_6O_3$, which occurs in colourless needles or prismatic rhombs, melting at 240° C., and subliming without decomposition. Readily soluble in alcohol and ether, sparingly in water, but imparting to the latter a blue colour in reflected light. The *mucilaginous matter* consists of soluble and insoluble *gums*.

Official Preparations.

Names.	Part Used.	Strength.	Dose.
Enema.	Gum-resin.	30 grs. to 4 ounces for one enema.	...
Pilula.	„	1 in $3\frac{1}{2}$.	5 to 10 grains.
Tinctura.	„	1 in 8.	$\frac{1}{2}$ to 1 fluid dr.
*Pilula Aloes et Asafœtidæ.	„	1 in 4.	5 to 10 grains.
*Spiritus Ammoniæ Fœtidus.	„	1 in $13\frac{1}{2}$ nearly.	$\frac{1}{2}$ to 1 fluid dr.

* These will be found under Aloes and Ammonia respectively.

ENEMA ASAFŒTIDÆ — ENEMA OF ASAFŒTIDA. — Enema Fœtidum.—*Take of asafœtida,* 30 *grains; distilled water,* 4 *fluid ounces. Rub the asafœtida in a mortar with the water added gradually, so as to form an emulsion.*

As in Mistura Ammoniaci the water dissolves the gum, this suspends the resin, and so an emulsion is formed.

PILULA ASAFŒTIDÆ COMPOSITA—COMPOUND PILL OF ASAFŒTIDA —Pilula Galbani Composita.—*Take of asafœtida, galbanum, myrrh, of each,* 2 *ounces; treacle, by weight,* 1 *ounce. Heat all together by means of a water-bath, and stir the mass until it assumes a uniform consistence.*

This is a most unworkable pill-mass, and the following formula has been suggested (Smith, *P.J.*, 4/4/91) : Asafœtida, galbanum, myrrh, of each, 2 ; glycerine, 1. Powder the gums with a few drops of spirit, and melt along with the glycerine on a water-bath to a suitable consistence to make into pills.

TINCTURA ASAFŒTIDÆ—TINCTURE OF ASAFŒTIDA.—*Take of asafœtida, in small fragments,* 2½ *ounces; rectified spirit, a sufficiency. Macerate the asafœtida in* 15 *fluid ounces of the spirit for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient rectified spirit to make* 1 *pint.*

An example of a tincture made by simple maceration. It is an alcoholic solution of the resin, and not being miscible in watery mixture mucilaginous substances must be added to suspend it.

Therapeutics.—Asafœtida acts as a stimulant and antispasmodic. It is contra-indicated in inflammatory disorders, and where there is irritation of the alimentary mucous membrane, in consequence of its general and topical stimulating effects. It is employed as an antispasmodic in convulsive disorders, especially those complicated with hysteria, in spasmodic nervous diseases of females, in chorea, epilepsy, uncomplicated fits of hysteria, &c. It is given also as a stimulating expectorant in spasmodic bronchial catarrh, especially in chronic cases of the aged. The enema is useful in hysteria, in constipation with flatulence and nervous colicky pains, and in infantile convulsions ; also to remove the tympanitic condition of the abdomen in low fevers. Is not now so popular with the profession as it once was. Its disagreeable odour is an objection to its use. When taken in large amount it would appear to be exhaled by the skin in small quantity. It appears in the milk of suckling women.

Adulterations or Substitutions.—A very impure drug contaminated with much earthy matter is known in Bombay as *Hingra.* One sample, yielding 86 per cent. of ash, consisted of small angular pieces of alabaster coated with resin of asafœtida. A fictitious substance made up of garlic juice and white pitch, with a little Asafœtida, has been detected in commerce. Asafœtida is said to be usually mixed with wheat or barley-flour, or with earthy matter at the place of its production, the impurity frequently exceeding 30 per cent. In America the drug is more subject to adulteration than in Britain. The following recent analysis (Ellwood, *P.J.*, 1891–92) shows the percentage composition of six samples :—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Per cent.
Volatile Oil,	4	5	6	8	9	10	,,
Ash, . . .	7	14	12	8·2	6·8	8	,,
Soluble in S.V.R., .	56	48	48	54	62	59	,,
Chips and leaves, .	0·5	6·3	3·4	1	0·8	1·2	,,

Ferula galbaniflua — Galbanum — Ferula rubricaulis — Galbanum.

GALBANUM — *Galbanum.*—A gum-resin obtained from *Ferula galbaniflua*, Boiss. and Buhse. ; *Ferula rubricaulis*, and probably other species. *Syn.* Gummi-resina Galbanum.

Holmes in 1888 pointed out that true Galbanum is not obtained from *F. rubricaulis*, for it has a highly alliaceous taste and odour. Genuine Galbanum is obtained from *F. galbaniflua*, Boiss., and *F. galbaniflua* var. *β-Ancheri*, Boiss., both growing in Northern Persia ; but much uncertainty exists as to what species of *Ferula* do and do not yield Galbanum. Commercial Galbanum is of two kinds, Levant and Persian, each of which exists in several varieties. Levant is probably derived from the sources mentioned by Holmes, while Persian is probably obtained from *F. Schair*, Borszczow. All the commercial Galbanum comes from or through Persia. Levant Galbanum is imported from Persia by way of Bombay ; and also from the Levant. It has a musky odour, and when heated gives off a pleasant aromatic scent. Persian Galbanum mostly finds its way into commerce through Russia by way of Astrachan and Orenburg. It is of a turpentine odour, and when heated has the decided terebinthinate smell. Liquid Persian Galbanum is of a reddish-brown colour, of Venice Turpentine consistence. It abounds in impurities, is chiefly found in Russia, and seldom in this country. Its odour differs from ordinary Galbanum. Holmes says it is derived from a species allied to *F. galbaniflua*. Levant Galbanum is found in (1) tears, (2) small lumps, (3) masses consisting of translucent yellowish small fragments. All three have a musky odour ; (1) and (2) are seldom found in commerce ; (3) is the variety found in the market during the last ten or twelve years.

Collection, &c.—It is doubtful whether the plant is incised or the juice flows out spontaneously.

Characters.—In tears or in masses of agglutinated tears. The tears are roundish or irregular in form, and vary in size from that of a lentil to a hazel-nut, although rarely exceeding that of a pea; yellowish-brown, orange-brown, or yellowish-green ; more or less translucent, usually rough and dirty on the surface, hard and brittle in cold weather, but softening in the summer, and by the heat of the hand becoming ductile and sticky. The masses, which commonly contain pieces of root, stem, and other impurities, are usually hard, compact, irregular in form, yellowish-brown, dark brownish-yellow, or rarely green. The odour is peculiar, aromatic, and not disagreeable ; taste, bitter, unpleasant, and somewhat alliaceous.[1]

[1] Ammoniacum is non-alliaceous ; Asafœtida is highly alliaceous.

Active Principles.—Contains 7 per cent. of *Essential Oil* of a pale yellow colour, and pronounced *Galbanum* odour ; specific gravity 0·914, and boils between 165° to 200° C. without decomposition, and contains a *sesqui-terpene*, $C_{15}H_{24}$, whose hydrochloride, $C_{15}H_{24}H_2Cl_2$, melts at 118° C. and 60 to 66 per cent. of *Resin* containing 72 to 74 per cent. of carbon and 8 to 8·5 of hydrogen, and soluble in alcohol, ether, and lime water. Alcoholic HCl, acting on the *resin*, yields *Umbelliferon*, $C_9H_6O_3$. It is also formed on dry-distilling the *resin*, and can be extracted by means of ether or chloroform. *Gum* is present to the extent of 15 per cent. On dry distillation *Galbanum* yields a *thick oil* of brilliant blue colour, which, on rectification and separation of the *Umbelliferon* by aqueous KOH, yields a *greenish portion* and then a superb *blue oil*, which appears to be identical with Chamomile Oil. By fractional distillation it can be separated into a *colourless oil* having the formula $C_{10}H_{16}$, boiling at 240° C. (and thus differing from the *essential oil* obtained by distilling Galbanum with water); and into a *blue oil*, $C_{10}H_{16}O$, boiling at 289° C. By fusing Galbanum with KOH, *resorcin* is obtained, together with *acetic and fatty volatile acids*. Treated with HNO_3 Galbanum yields *trinitroresorcinal* (*Styphnic or oxypicric acid*), $C_6H(NO_2)_3(OH)_2$ (see also Ammoniacum and Asafœtida). Hanbury and Flückiger give the following tests to distinguish *Galbanum* from *Asafœtida* and

Ammoniacum:—If *Galbanum*, or still better its resin, be very moderately warmed with strong HCl, a red hue is developed which turns *violet or bluish* if spirit is slowly added; *Asafœtida*, treated as above, assumes a *dingy greenish colour*, while *Ammoniacum* is *not* affected at all by the test. The *fluorescence* (due to Umbelliferon) test distinguishes Asafœtida and Galbanum from Ammoniacum. A solution of the two former becomes blue on the addition of ammonia. Ammoniacum is not affected.

Official Preparation.

Name.	Part Used.	Strength.
Emplastrum.	Gum-resin.	1 in 11.

Also contained in *Pilula Asafœtidæ Composita* (1 in $3\frac{1}{2}$).

EMPLASTRUM GALBANI—GALBANUM PLASTER—PREPARATION.—*Take of galbanum, ammoniacum, yellow wax, of each,* 1 *ounce; lead plaster,* 8 *ounces. Melt the galbanum and ammoniacum together, and strain; then add them to the lead plaster and wax, also previously melted together, and mix the whole thoroughly.*

TINCTURA GALBANI—TINCTURE OF GALBANUM.—*Of the strength of* 1 *in* 16 *made with rectified spirit*—(*not official*).

Like the Tincture of Asafœtida, this is a solution of the resin.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.

Therapeutics.—Galbanum acts as a stimulant and antispasmodic, less energetic than asafœtida or ammoniacum. Only used externally in the form of plaster, which is employed as a stimulant and resolvent application to indolent tumours; also to the chest in pulmonary affections, and to the lumbar regions in weakness of the lower extremities. It was formerly used internally in amenorrhœa and in chronic rheumatism, administered in pill form or in emulsion like the *Mistura Ammoniaci.* The plaster, spread on leather, is occasionally applied to boils.

Adulterations or Substitutions.—Asafœtida and ammoniacum may be added to galbanum, as also the inferior qualities of the drug. Large admixture of impurities are occasionally found.

Opoponax Chironium, Koch—Opoponax—(*not official*).—*Syn.* Pastinaca Opoponax, Linn.; Ferula Opoponax.—A gum-resin possessing in a feeble degree the properties of galbanum and asafœtida.

It was at one time official in the Edinburgh Pharmacopœia. It consists of *gum*, *resin*, *starch*, *volatile oil*, *lignin*, and *malic acid*, &c. It is now said to be out of commerce. It is allied to ammoniacum.

Sagapenum—Sagapenum—Serapinum—(*not official*).—Allied to galbanum, but whose botanical source is unknown (by some supposed to be *Ferula persica*, a source of Asafœtida). It is really an inferior asafœtida possessing similar properties. It consists of *arabin*, *bassorin*, *volatile oil*, and *resin*. Formerly *Pilula Sagapeni Composita* was official in the London and Dublin Pharmacopœias, and it was also a constituent of *Pilula Galbani Composita* and *Conserva Ristæ* of the same Pharmacopœias. The *dose* is 10 to 30 grains. A mixture of asafœtida and galbanum is often sold as Sagapenum.

Thapsia garganica, Linn.—Silphion or Silphium—(*not official*).—Is official in the French Codex in the shape of *Resina Thapsiæ*. Narthex Silphium or Thapsia Silphium is said to be a variety of the above. They possibly contain two *resins*, *gum*, *octoic* (*caprylic*) *acid*, and *thapsic acids*. The drug was at one time used internally as an emetic and purgative, and externally to the chest in pulmonary conditions, especially phthisis, as a severe counter-irritant.

Nat. Ord. **ARALIACEÆ**—The Ivy Order.—Trees, shrubs, or herbs—(*not official*).

Hedera Helix, Linn.—The Ivy.—Contains a supposed glucoside *Hederic Acid*. Is said to be diaphoretic, and its berries are emetic and purgative. A gum-resin is prepared from the plant.

Panax Quinquefolium, Linn.—Panax—Ginseng—(*not official*).—A native of North America and Asia. The root, which is the part used medicinally, contains *starch*, *gum*, &c., and a *sweet principle*, *Panaquilon*, $C_{12}H_{25}O_9$, precipitated from aqueous infusion by adding sodium sulphate to saturation. Concentrated H_2SO_4 gives a purple colour with it, and turns it into *Panacon*, $C_{11}H_{19}O_4$. Ginseng is reputed to be stomachic and aphrodisiac, and has been given in dyspepsia and nervous disorders. It is prescribed in the form of infusion (1 to 20).

Dose.—One fluid ounce.

Nat. Ord. **CORNACEÆ**—The Dogwood Order.—Shrubs, trees, or rarely herbs—(*not official*).

Cornus florida, Linn.—Dogwood—(*not official*).—Grows in Canada and the United States. The bark is official in the U.S.P.

Active Principles, are *resin*, *fixed oil*, *tannin*, *gallic acid*. The *resin* crystallises in needles. In addition, a bitter principle, *Cornin* or *Cornic Acid*, obtained by treating the aqueous solution with lead hydrate, filtering, extracting the filtrate with absolute alcohol, and purifying.

EXTRACTUM CORNUS FLUIDUM—FLUID EXTRACT OF CORNUS, U.S.P.—*Prepared with glycerine and diluted alcohol, by percolation, so that one part of the fluid extract represents one of the drug.*

Dose.—1 fluid drachm.

Therapeutics.—Is said to increase the force and frequency of the pulse, but its pharmacology has not been worked out. It is a bitter tonic, and is taken chiefly for its tonic effects. For a long time it was used in the swamps of America in malaria, but has now almost entirely given place to quinine.

Nat. Ord. **CAPRIFOLIACEÆ**—The Honey-Suckle Order.—Small trees, shrubs, or rarely herbs. Distributed over the northern parts of Europe, Asia, and America. They have showy flowers, many of them are sweet scented. They are often cultivated for their beauty.

Official Plant.

Botanical Name.	Part Used.	Habitat.
SAMBUCUS NIGRA.	Fresh flowers.	Indigenous.

Sambucus nigra—(*S. maderensis*)—The Elder—The Bore Tree—The Bour Tree.

Botany.—Arborescent. *Stem*, shrubby, much and always oppositely though irregularly branched. *Leaves*, pinnate; leaflets, two pairs, with an odd one. *Flowers*, white or cream-coloured, in large terminal cymes. *Fruit*, a globular black, three to four-seeded berry. *Habitat*, indigenous.

SAMBUCI FLORES—*Elder Flowers.*—The fresh flowers of *Sambucus nigra*, Linn. From indigenous plants.

Characters.—In corymbose cymes, from 5 to 7 inches across. Flowers small,[1] calyx superior, 5-toothed; corolla flat, rotate, 5-sected, creamy white, with 5 stamens inserted in the tube. Odour, fragrant, but somewhat sickly; taste bitterish.

[1] The flowers of the American Elder, *Sambucus canadensis*, Linn., are much larger.

Active Principles.—The leaves contain a *volatile oil* (about $\frac{1}{8}$ per cent.), buttery in consistence, and easily decomposed when exposed to the air. *Resin*, *tannin*, and other constituents are also present.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Aqua.	Fresh flowers, or flowers preserved in salt.	1 in 1	1 to 2 fluid ounces.

AQUA SAMBUCI—ELDER-FLOWER WATER—PREPARATION.—*Take of fresh elder flowers, separated from the stalks,* 10 *pounds, or an equivalent quantity of the flowers preserved while fresh with common salt ; water,* 2 *gallons. Distil* 1 *gallon.*

This preparation is usually distilled treble or quadruple strength. It thus keeps better, as the pharmacopœial preparation soon develops fungoid growths. A 5 per cent. admixture of glycerine would preserve it.

ELDER FRUIT—Elder Berries—(*not official*).—Are used to make so-called elder berry wine.

ELDER LEAVES—(*not official*).—Are often used to give a fine green colour to oils, ointments, and soaps.

ELDER BARK—(*not official*).—Is said to contain *tannin*, *sugar*, *resin*, and *valerianic acid.*

Therapeutics.—The elder is not much used in medicine ; the flowers are somewhat stimulant and slightly diaphoretic ; the berries are aperient and diuretic, and the liber or inner bark of the tree is cathartic and emetic. Preparations of the bark have been given in dropsy and in epilepsy. The water is occasionally used as a flavouring vehicle for other remedies, but more commonly as a cosmetic. The expressed juice of the berries has been given as a diuretic, as well as a decoction of the inner bark (2 oz. to 2 pints boiled down to 1 pint), in 2 to 4 fluid ounce doses.

Adulterations.—Elder flowers are not subject to systematic adulteration. The flowers of *Sambucus canadensis* are like those of *S. nigra*, and they are official in the U.S.P., but they can be distinguished by being pure white in colour, and larger, with cymes larger and more loose, and having a less marked odour.

Viburnum prunifolium—Black Haw—(*not official*)—*Habitat.*—United States of America

VIBURNI CORTEX—*Black Haw Bark.*—The dried bark of *Viburnum prunifolium*, Linn.—(*not official*). The root-bark is also used.

Characters.—In quills, dark brown and warty externally ; white and smooth internally.

Active Principles.—Tannin, resin, malic, citric, and *oxalic acids, sugar, valerianic acid,* and *Viburnin,* a yellowish, neutral bitter powder of which the formula is unknown. It is probably a glucoside.

EXTRACTUM VIBURNI FLUIDUM—Fluid Extract of Viburnum, U.S.P.—(*not official*).—*Made by percolation with diluted alcohol, so that one part of the extract represents one of the bark.*

Dose.—½ to 1 fluid drachm.

Therapeutics.—Little is known of its physiological action. In this country it has been chiefly brought before the profession as a remedy in dysmenorrhœa, in menorrhagia, and as a preventive of abortion.

Nat. Ord. **RUBIACEÆ**—The Madder Order.—Trees, shrubs, or herbs. The Order has been divided into two—*Galiaceæ* and *Cinchonaceæ*—the former natives of the northern hemisphere, the latter of the southern hemisphere. All the official plants belong to the *Cinchonaceæ*, and possess properties of the highest medicinal value.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Uncaria Gambier.	Extract of leaves and young shoots.	Singapore and Eastern Archipelago.
Cinchona { Calisaya, officinalis, Succirubra, lancifolia, and other species. }	Dried bark.	South America. Cultivated also in the East Indies.
Cephaëlis Ipecacuanha.	Dried root.	Brazil.
Coffea arabica.[1]	Dried seeds.	Tropical Africa and Abyssinia.

[1] Official only as a source of Caffeine.

Uncaria Gambier—Nauclea Gambir—The Catechu Shrub.

Catechu—Catechu pallidum—Extractum Uncariæ—*Catechu—Pale Catechu—Gambir—Gambier—Terra Japonica.*—An extract of the leaves and young shoots of *Uncaria Gambier*, Roxb.

The Gambier plant is cultivated in plantations around Singapore chiefly, where it forms an important industry. The plants are allowed to grow till 8 or 10 feet high, when three or four times each year they are stripped of their leaves and young shoots, which are boiled for an hour or more in an iron pan. At the end of this time the decoction is poured off, the residue squeezed out, and the decoction evaporated down to a syrupy consistence ; when sufficiently hardened, it is cut into squares and dried in the shade. The leaves and shoots are subjected to a second treatment to thoroughly remove all the astringent matter.

Characters and Tests.—In cubes or masses of variable size formed of more or less agglutinated cubes. The separate cubes are usually about 1 inch square, deep reddish-brown externally,[1] pale cinnamon-brown internally, dry, breaking readily with a dull earthy fracture, and, when viewed under the microscope, presenting myriads of very small acicular crystals.[2] Taste at first bitter and very astringent, but subsequently sweetish ; no odour. Entirely soluble in boiling water.[3] The decoction when cold is not rendered blue by iodine.[4]

[1] *Catechu nigrum* is blackish. [2] Catechin or Catechuic Acid. [3] Absence of earthy matters, &c. It is soluble to about 75 per cent. in rectified spirit and 50 per cent. in cold water. [4] Shows absence of starchy matter.

Dose.—10 to 30 grains in powder.

Active Principles.—Contains *colouring matter*, *mucilage*, *insoluble matters*, *Quercitin*, *Catechin* or *Catechuic Acid*, and *Catechu-tannin*. *Quercitin*, $C_{24}H_{16}O_{11}+3H_2O$, is obtained from the aqueous solution, but only sparingly ; it is more soluble in ether. Water also removes *Catechin*, $C_{21}H_{18}O_8$, or $C_{21}H_{20}O_9+5H_2O$. It forms silky needles soluble in water, but more so in alcohol and ether ; ferric salts give with it a green colour, and it is precipitated by most metallic salts, but not by tartar emetic nor by gelatin. When fused with caustic potash it yields *protocatechuic acid* and *phloroglucin*. The most important constituent of catechu is, however, *Catechu-tannic acid* or *Mimo-tannin*. It is soluble in cold water, and gives with ferric salts a green colour, thus differing from the blue-black of *gallo-tannin*, and it is further distinguished from gallo-tannin by not being precipitated by tartar emetic and by not being converted into *pyrogallic acid* on heating.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Bruised Catechu.	1 to 30.	1 to 2 ounces.
Pulvis Compositus.	Powdered ,,	1 in $2\frac{1}{2}$.	20 to 40 grains.
Tinctura.	,, ,,	1 in 8.	$\frac{1}{2}$ to 2 drachms.
Trochisci.	,, ,,	1 grain in each.	1 to 6.

INFUSUM CATECHU—INFUSION OF CATECHU.—*Take of catechu, in coarse powder,* 160 *grains; cinnamon bark, bruised,* 30 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

PULVIS CATECHU COMPOSITUS—COMPOUND POWDER OF CATECHU.—*Take of catechu, in powder,* 4 *ounces; kino, in powder, rhatany root, in powder, of each* 2 *ounces; cinnamon bark, in powder, nutmeg, in powder, of each,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally, rub it lightly in a mortar. Keep it in a stoppered bottle.*

TINCTURA CATECHU—TINCTURE OF CATECHU.—*Take of catechu, in coarse powder,* 2½ *ounces; cinnamon bark, bruised,* 1 *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make* 1 *pint.*

TROCHISCI CATECHU—CATECHU LOZENGES.—*Take of catechu, in powder,* 720 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water, a sufficiency. Mix the catechu, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains* 1 *grain of catechu.*

Therapeutics.—Catechu acts as a powerful astringent, and is used in chronic non-inflammatory diarrhœa, and in dysentery, generally in combination with chalk, opium, or other astringents. The tincture is more efficacious than the infusion, probably because catechu is not so soluble in water. As a stomachic it is sometimes found to be serviceable in dyspepsia when given before meals. In passive uterine hemorrhages, and in mucous discharges from any of the mucous membranes, catechu is also employed. It is chewed or taken in the form of the lozenge as an application to relaxed throats, to obviate hoarseness in public speakers and singers, and in ulcers of the mouth. As a topical astringent it is applied externally to ulcers, sore nipples, &c.

Incompatibles.—Metallic Salts, Alkalis.

Adulterations or Substitutions.—Earthy matter, pieces of rag, leaves, and wood are often found. Catechu nigrum, Cutch or Kutch, prepared from Acacia Catechu, is official in the U.S.P., and in 1864 was recognised in the B.P. It is much darker in colour than the official catechu, and when broken, presents a brown colour internally instead of the pale colour of the official variety. It is found in masses of several pounds weight, made up of oblong pieces, and is said to possess greater astringency than the official kind. Ordinary commercial Pale Cutch, as prepared in Northern India, contains a relatively small amount of catechu-tannin, and a large proportion of catechin. As before mentioned, catechin is only sparingly soluble in cold water, and therefore this variety gives up but a small proportion of its astringency to water. At one time a part of the catechu of commerce was prepared in Ceylon from Areca Nuts (Areca Catechu). It was of very inferior quality, and is not now in commerce.

Cinchona Calisaya—The Cinchona Tree—Calisaya Cinchona—Yellow Cinchona.

Cinchona officinalis—The Cinchona Tree—Peruvian Cinchona—Pale Cinchona—Loxa or Crown Cinchona.

Cinchona succirubra—The Cinchona Tree—Red Cinchona.

Cinchona lancifolia—The Cinchona Tree—Columbian, Carthagena or Caqueta Cinchona.

To obtain the official alkaloids any kind of bark may be used (*Cinchonæ Cortex*); for making the official galenical preparations only the red bark (*Cinchonæ rubræ Cortex*) is allowed.

CINCHONÆ CORTEX—*Cinchona Bark.*—The dried bark of *Cinchona Calisaya*, Weddell; (*C. Weddelliana*) *C. officinalis*, Linn.; (*C. Uritusinga*, Pavon) *C. succirubra*, Pavon; (*C. Howardiana*) *C. lancifolia*, Mutis; and other species of Cinchona from which the official alkaloids may be obtained.

CINCHONÆ RUBRÆ CORTEX—*Red Cinchona Bark.*—The dried bark of the stem and branches of cultivated plants of *Cinchona succirubra*, Pavon.

Characters.—In quills or more or less incurved pieces, coated with the periderm, and varying in length from usually a few inches to a foot or more—the bark itself from about one-tenth to a quarter of an inch thick, or rarely more; outer surface more or less rough from longitudinal furrows and ridges, or transverse cracks, annular fissures, and warts, and brownish or reddish-brown in colour; inner surface brick-red or deep reddish-brown, irregularly and coarsely striated; fracture nearly close in the smaller quills, but finely fibrous in the larger ones; powder brownish or reddish-brown; no marked odour; taste bitter and somewhat astringent.

Test.—When used for purposes other than that of obtaining the alkaloids or their salts, it should yield between 5 and 6 per cent. of total alkaloids, of which not less than half shall consist of quinine and cinchonidine, as estimated by the following methods (a modification of De Vry's):—

SUMMARY OF B.P. PROCESS.

I. For Quinine and Cinchonidine.

A. Mix 200 grains in No. 60 powder with 60 grains calcium hydrate, and add half an ounce of water. Mix and allow to stand for an hour or two.[1] There should be no lumps or white particles in it.

B. Exhaust with benzolated amylic alcohol by boiling, decanting, and percolating.

C. Shake the filtrate with dilute hydrochloric acid, and remove the acid fluid containing the hydrochlorates of the alkaloids by means of a separator.

D. Neutralise carefully with ammonia while warm, and concentrate the fluid by evaporation.

E. Add 15 grains tartarated soda dissolved in half a drachm of water, and let the mixture stand, when insoluble tartrates will separate out. These dried and weighed will represent $\frac{8}{10}$ths of their weight of alkaloids, and divided by 2 represent the percentage. The other alkaloids will be left in the mother-liquor.

[1] This sets free the pure alkaloids from their combination with Cincho-tannic Acid, and they are dissolved by the alcohol.

II. For Total Alkaloids.

A. To the mother-liquor of preceding process add ammonia in excess.

B. Wash, dry, and weigh the precipitate.

C. Divide the result by 2, add the percentage result of I., and the total alkaloid percentage will be obtained.

Description of the other barks used in preparing the official alkaloids—

1. CINCHONA CALISAYA, Wedd.—The bark is found flat or in quills. The flat variety is $\frac{1}{8}$ to $\frac{1}{2}$ inch thick, consists almost entirely of liber, and is uncoated; texture firm, compact, and uniform. The colour is brown, with darker patches, and the surface has furrows or depressions on it called digital furrows. Internally the colour is yellowish, and the surface has a fibrous appearance. The quills vary in thickness, are usually single and coated; externally brown, often with lichens, and with annular rings, giving a rough characteristic appearance; internally deep cinnamon-brown colour. It breaks with a smooth fracture.

2. CINCHONA OFFICINALIS, Linn.—The bark occurs in quills, and has the following characters:—From half a line to a line thick, in single or double quills, which are from 6 to 15 inches long, two to

eight lines in diameter, brittle, easily splitting longitudinally, and breaking with a short transverse fracture ; outer surface brown and wrinkled, or grey, speckled with adherent lichens ; with or without numerous transverse cracks ; inner surface bright orange or cinnamon-brown ; powder, pale brown, slightly bitter, very astringent. This bark was at one time chiefly imported from Loxa in Ecuador, but it is now cultivated in India, Ceylon, and Java.

3. Cinchona lancifolia, Mutis.—Is a native of New Granada, but is cultivated in India and Java. The bark is found in large quills or thick flat or curved pieces. Externally it is yellowish, and has a soft white cork ; internally it is dull reddish with white dots often scattered here and there. It breaks with a long fibrous fracture, and on this account has been called *fibrous* Calisaya Bark.

Remijia pedunculata (*Cinchona pedunculata*, Karsten), and other species—Cuprea Bark.—It will grow in a dry climate and a little above sea-level. The bark is found in pieces 3 to 4 inches long and $\frac{1}{12}$ to $\frac{1}{4}$ inch thick. It is of a coppery tint, inner surface smooth ; outer smooth or rough. Texture dense, hard, and fracture short, not fibrous. The bast (or liber cells) are small and their cavities widely open.

It is important to note the microscopic structure of the various barks.

C. succirubra.—No stone cells, and its laticiferous ducts are in one row. Bast (or liber) fibres medium in thickness, in lines of 2 to 8.

C. Calisaya.—No stone cells, but it has laticiferous ducts in young bark. Bast (or liber) fibres of medium thickness.

C. officinalis.—No stone cells, and its laticiferous ducts are soon obliterated. Bast (or liber) fibres medium in thickness and in lines of 2 to 4.

C. lancifolia.—Numerous stone cells, but no laticiferous ducts. Bast (or liber) fibres of medium and thicker dimensions, and in single and double lines of 2 to 4.

The following Barks may also be noted as sources of the alkaloids:—

Cinchona Pitayensis—Pitaya Bark.—In flat or curved pieces $\frac{1}{4}$ inch thick, covered with a yellowish cork, and marked with circular scars. The bast is cinnamon-red ; it breaks with a splintery fracture.

Cinchona pubescens—Cusco Bark.—Is pale brownish externally, and the inner layer is cinnamon coloured. The fracture on the outside is smooth, but splintery internally.

Cinchona peruviana and **C. micrantha**—Lima or Huanuco Bark.—Are also known in commerce, but are of little importance medicinally.

Active Principles of the Various Barks.—The most important constituents are *Quinine*, $C_{20}H_{24}N_2O_2$; *Cinchonine*, $C_{20}H_{24}N_2O$; *Cinchonidine*, $C_{20}H_{24}N_2O$; *Quinidine* or *Conquinine*, $C_{20}H_{24}N_2O_2$; *Quinamine*, $C_{19}H_{24}N_2O_2$; *Conquinamine* or *Conchinamine*, $C_{19}H_{24}N_2O_2$.

Less important bases are *Paricine*, $C_{16}H_{18}N_2O$; *Aricine*, $C_{23}H_{26}N_2O_4$; *Cusconine*, having the same formula as *Aricine*, but crystallising with 2 molecules of water. Many other alkaloids and various volatile liquid bases have been obtained from cinchona, but they are of little practical importance.

The alkaloids are combined in the bark with *quinic* (*kinic*) *acid*, $C_7H_{12}O_6$, *cinchotannic* (*quinotannic*) *acid*, and *quinovic* (*chinovic*) *acid*. *Quinovin* (*Chinovin*, *Kinovin*), $C_{30}H_4O_8$, a bitter glucoside, *Cinchona-red*, a colouring matter, starch, gum, resin, &c., are also present.

Percentage Composition of Various Barks.—*C. lancifolia* may be devoid of *quinine*, and at other times contains 3 to 4 per cent. *C. officinalis* has been known to contain 9·1 per cent. of *quinine* and 2·8 of other alkaloids, and good flat bark usually contains not less than 5 to 6 per cent. Pale bark is variable in its yield. *C. succirubra;* the flat contains only 3 or 4 per cent. of alkaloids, while the quill yields 5 to 10 per cent.—1·75 to 3·5 per cent. being *quinine*, 1·25 to 3 per cent. *cinchonidine*, and 2 to 4 per cent. *cinchonine*, with traces occasionally of *conquinine*. The alkaloidal yield of *Remijia* is about 1·1 per cent. — *quinine*, *cinchonine*, and *homoquinine* (or *cupreine*).

Collection, &c.—The cinchona tree is a native of the northern parts of South America, growing on the western slopes of the Andes at an elevation of 2000 to 8000 feet above sea-level. In 1638 the bark was used to cure the Countess of Chinchon, wife of the Viceroy of Peru, of an ague, and by her and Jesuit missionaries was soon afterwards introduced into Europe. It was collected by felling the trees and stripping off the bark, which wasteful method in time threatened to stop the supply entirely. In 1854, the Dutch Government, and in 1859, the English, introduced various species into their East Indian possessions, where they have been successfully cultivated. Large plantations now flourish in the Nilgiri Hills, Ceylon, and other mountainous districts of India, and our chief supplies are derived from these.

From the Bark of Cinchona Succirubra.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Bruised Bark.	1 in 16.	1 to 2 fluid ounces.
Extractum Liquidum.	„ „	5 per cent. alkaloids.	5 to 10 minims.
Infusum Acidum.	„ „	1 in 20.	1 to 2 fluid ounces.
Tinctura.	„ „	1 in 5.	½ to 2 fluid dr.
„ Composita.	„ „	1 in 10.	„ „ „

Also contained in Mistura Ferri Aromatica (1 in 16).

DECOCTUM CINCHONÆ—Decoction of Cinchona.—*Take of red cinchona bark, in No.* 20 *powder,* 1¼ *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel. Strain the decoction when cold,*[1] *and pour as much distilled water over the contents of the strainer as will make the strained product measure* 1 *pint.*

[1] Cincho-tannates are soluble in hot decoction, but separate out on cooling, and are left on the filter.

EXTRACTUM CINCHONÆ LIQUIDUM—Liquid Extract of Cinchona.—*Red Cinchona bark in powder,* 20 *ounces; hydrochloric acid,* 5 *fluid drachms; glycerine,* 2½ *ounces; rectified spirit and distilled water, of each, a sufficiency. Macerate the bark with* 5 *pints of water, together with the acid and glycerine; macerate for* 48 *hours, and then percolate till that which is passing ceases to give a precipitate with excess of soda solution, and next evaporate in an enamelled vessel at a temperature not exceeding* 180° *F.* (82·2° *C.*) *to* 20 *fluid ounces. The amount of alkaloid present should now be ascertained,*[1] *and every fluid part of it containing* 5 *grains of total alkaloids is first to be brought to the volume of* 85 *grains by evaporation, or if necessary by dilution with water, then* 12·5 *fluid grains of rectified spirit are to be added, and the final adjustment of the volume to* 100 *fluid grains is effected by the addition of distilled water. The liquid extract thus prepared contains* 5 *grains of the alkaloids of the bark in every* 100 *fluid grains.*

[1] By agitating 50 fluid grains with benzolated amylic alcohol, 1 fluid oz., and soda solution, ½ fluid oz., removing the alkaline watery fluid, washing the alcohol with water, evaporating the alcoholic extract to dryness on a water-bath, weighing and multiplying by 2, when the percentage alkaloidal strength will be found.

INFUSUM CINCHONÆ ACIDUM—Acid Infusion of Cinchona—*Syn.* Infusum Cinchonæ.—*Take of red cinchona bark, in No.* 40 *powder,* ½ *ounce; boiling distilled water,* 10 *fluid ounces; aromatic sulphuric acid,* 1 *drachm. Infuse in a covered vessel for one hour, and strain.*

This is a solution of the sulphates of the alkaloids.

TINCTURA CINCHONÆ.—Tincture of Cinchona.—*Take of red cinchona bark, in No.* 40 *powder,* 4 *ounces; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

TINCTURA CINCHONÆ COMPOSITA—Compound Tincture of Cinchona.—*Take of red cinchona bark, in No.* 40 *powder,* 2 *ounces; bitter orange-peel, cut small and bruised,* 1 *ounce; serpentary rhizome bruised,* ½ *ounce; saffron,* 55 *grains; cochineal, in powder,* 28 *grains; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

From all the Barks.—*Official Preparations.*

Cinchonidinæ Sulphas, . . .	*Dose,* 1 to 10 grains.
Cinchoninæ Sulphas, . . .	*Dose,* „ „
Quininæ Hydrochloras, . . .	*Dose,* „ „
Quininæ Sulphas, ...	*Dose,* „ „

Quinine and Cinchonine may also be obtained from species of *Remijia.*

CINCHONIDINÆ SULPHAS—Sulphate of Cinchonidine, $(C_{20}H_{24}N_2O)_2,H_2SO_4,3H_2O$.—The sulphate of an alkaloid from the bark of various species of cinchona.

Preparation.—*From the mother-liquors of the sulphate of quinine by further concentration, purified by crystallisation from alcohol and finally from hot water.*

Characters and Tests.—In colourless silky crystals usually acicular. Soluble in alcohol, water, or ether;[1] almost insoluble in chloroform,[2] or in solution of ammonia; readily in dilute acids. The watery solution has a bitter taste and a neutral or faintly alkaline reaction, twists a ray of polarised light [3] to the left, and when acidified is not distinctly fluorescent.[4] Gives a white precipitate with barium chloride,[5] and also with solution of tartarated soda, the filtrate from which occasions no more than a turbidity with ammonia.[6] Dissolves in pure sulphuric acid with only a faint yellow coloration, and the fluid undergoes no apparent change when gently warmed.[7] Twenty-five grains lose 1·76 grain of moisture on drying at 212° F.[8] (100° C.). When ignited in air leaves no ash.[9]

[1] Cinchonine sulphate is insoluble in ether. [2] The cinchonine

salt is soluble in chloroform. [3] Cinchonine salt turns it to the right. [4] Absence of quinine or quinidine. [5] Showing it is a sulphate. [6] Absence of cinchonine salt. [7] Absence of foreign organic matter. [8] Water of crystallisation. [9] Absence of inorganic matters.

CINCHONINÆ SULPHAS — SULPHATE OF CINCHONINE, $(C_{20}H_{24}N_2O)_2,H_2SO_4,2H_2O$.—The sulphate of an alkaloid obtained from the bark of various species of *Cinchona* and *Remijia*.

PREPARATION.—*From the mother-liquors of the crystallisation of the sulphates of quinine, cinchonidine, and quinidine by precipitating the alkaloid with caustic soda, washing it with spirit until free from other alkaloids, dissolving in sulphuric acid, and after purifying the solution with animal charcoal allowing to crystallise.*

Characters and Tests.—Hard, colourless, short, prismatic crystals with a vitreous lustre. Soluble in water and in chloroform,[1] almost insoluble in ether [2] and in solution of ammonia, readily soluble in rectified spirit and in dilute acids. The aqueous solution has a bitter taste, a neutral or faintly alkaline reaction, and twists a ray of polarised light to the right.[3] Its acidified solution is not fluorescent,[4] and gives a white precipitate with barium chloride.[5] It dissolves in pure sulphuric acid without change of colour,[6] and the fluid undergoes no apparent change when gently warmed. Twenty-five grains of the salt should lose 1·26 grain of moisture when dried at 212° F.[7] (100° C.), and should then almost dissolve in 4 ounces by weight of chloroform. When ignited in air no ash remains.[8]

[1] The cinchonidine salt is insoluble. [2] The cinchonidine salt is soluble. [3] Cinchonidine turns it to the left. [4] Absence of quinine or quinidine. [5] Showing it is a sulphate. [6] Absence of foreign organic matter. [7] Water of crystallisation. [8] Absence of inorganic matter.

QUININÆ HYDROCHLORAS—QUINIÆ HYDROCHLORAS—HYDROCHLORATE OF QUININE—HYDROCHLORATE OF QUINIA, $C_{20}H_{24}N_2O_2HCl,2H_2O$.

PREPARATION.—*As for sulphate of quinine, the separated alkaloid being neutralised by hydrochloric acid.*

Characters and Tests.—In crystals like quinine sulphate, but generally larger. It is soluble in about 34 parts of water and 3 parts of spirit at common temperatures, and very soluble in the boiling liquids. Its solution when treated with chlorine water and then with ammonia, becomes green,[1] and with barium chloride gives only a faint turbidity,[2] and with silver nitrate a white precipitate insoluble in nitric acid.[3] It may be converted into quinine sulphate by dissolving it together with an equal weight of sodium sulphate in 10 times its weight of hot distilled water, and setting the mixture aside at 60° F. (15·5° C.) for half an hour, and the product should answer the *characters and tests* of quinine sulphate. Dried at 212° F. (100° C.), it loses 9 per cent. of water.[4]

[1] This is the thalleioquin test, and is not given with cinchonine, cinchonidine, quinamine, or conquinamine. [2] Absence of more than a trace of sulphate. [3] Presence of chloride. [4] Water of crystallisation.

Official Preparation.

Name.	Strength.	Dose.
Tinctura.	1 grain in each fluid drachm.	$\frac{1}{2}$ to 2 fluid drachms.

TINCTURA QUININÆ—TINCTURE OF QUININE.—*Take of hydrochlorate of quinine,* 160 *grains; tincture of orange-peel,* 1 *pint. Dissolve the hydrochlorate of quinine in the tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally, and afterwards filter.*[1]

[1] The tannin of the orange-peel throws down tannate of alkaloids in small amount. These settle down and are filtered off.

QUININÆ SULPHAS—QUINIÆ SULPHAS—SULPHATE OF QUININE—SULPHATE OF QUINIA, $((C_{20}H_{24}N_2O_2)_2H_2SO_4)_2 15H_2O$.

PREPARATION.—*From the powder of various kinds of Cinchona and Remijia bark by extraction with spirit after the addition of lime, or by the action of alkali on an acidulated aqueous infusion, with subsequent neutralisation of the alkaloid by sulphuric acid and purification of the resulting salt.*

Characters and Tests.—Filiform silky snow-white crystals, of a pure intensely bitter taste, sparingly soluble in water, that is, 1 part in 700 or 800 parts at common temperatures, yet imparting to the water a bluish tint or fluorescent appearance.[1] Entirely soluble in water acidulated by sulphuric acid. Its solutions give with chloride of barium a white precipitate insoluble in nitric acid,[2] or when treated first with solution of chlorine and afterwards with ammonia they become of an emerald-green colour,[3] and solution of ammonia gives with them a white precipitate of quinine soluble in ether and in excess of the solution of ammonia.[4] It dissolves in pure sulphuric acid with a feeble yellowish tint,[5] and undergoes no further change of colour when gently warmed. Twenty-five grains of the freshly-prepared salt should lose 3·8 grains of water by drying at 212° F. (100° C.).[6] Ignited with free access of air, it burns without leaving any residue.[5]

The *B.P.* tests for quinine sulphate are summarised as follows :—

For Cinchonidine and Cinchonine.

A. Put 100 grains quinine sulphate and 3 drops dilute sulphuric acid into 5 oz. boiling water. Set aside for quinine sulphate to crystallise ; filter.

B. Shake the filtrate with ether till you have a good layer of the latter undissolved.

C. Add just sufficient ammonia to redissolve the quinine, and set aside for a night.

D. Remove the ether layer by pipette, and wash aqueous fluid with more ether.

E. Collect the separated alkaloid on a tared filter, and wash with ether ; dry at 100° C. and weigh. Four parts = 5 parts crystallised *cinchonine* or *cinchonidine sulphates.*

For Quinidine.

A. Recrystallise 50 grains quinine sulphate as aforementioned.

B. To filtrate, add solution of potassium iodide and a little rectified spirit to prevent precipitation of amorphous hydriodates.

C. Collect any separated quinidine hydriodate, wash with water, dry and weigh.

The weight represents about an equal weight of quinidine sulphate.

For Cupreine.

A. To the recrystallised quinine sulphate obtained in testing for cinchonine and cinchonidine add an ounce of ether and 2 drachms ammonia solution ; add also the ethereal fluid and aqueous washings used in the cinchonine and cinchonidine testing. Shake them up.

B. Remove the ether and shake it with 2 drachms of a 10 per cent. caustic soda solution, and wash the aqueous solution with more ether, and remove the ether as before.

C. Neutralise the aqueous fluid with sulphuric acid, and allow cupreine sulphate to crystallise out.

D. Dry and weigh.

Sulphate of quinine should contain not much more than 5 per cent. of sulphates of other cinchona alkaloids.

1 Not given by cinchonine or cinchonidine. 2 Presence of sulphate. 3 Thalleioquin test—not given by cinchonine or cinchonidine. 4 Quinine is more soluble in ammonia than the other cinchona

alkaloids, and on this account Kerner has devised a quantitative method of estimation. [5] Absence of organic matter. [6] Water of crystallisation.

Official Preparations.

Name.	Strength.	Dose.
Ferri et Quininæ Citras.[1]	16 in 100 (about).	3 to 10 grains.
Tinctura Ammoniata.	1 grain in 1 fluid drachm.	$\frac{1}{2}$ to 2 fluid drachms.
Vinum.	1 grain in 1 fluid ounce.	$\frac{1}{2}$ to 1 fluid ounce.

[1] Described under Iron.

TINCTURA QUININÆ AMMONIATA—Ammoniated Tincture of Quinine.—*Take of sulphate of quinine,* 160 *grains; solution of ammonia,* $2\frac{1}{2}$ *fluid ounces; proof spirit,* $17\frac{1}{2}$ *fluid ounces. Dissolve the sulphate of quinine in the spirit with a gentle heat, and add the solution of ammonia.*

This is really quinine dissolved in excess of ammonia and alcohol. If cinchonidine be present it is precipitated.

VINUM QUININÆ—Wine of Quinine—Quinine Wine.—*Take of sulphate of quinine,* 20 *grains; citric acid,* 30 *grains; orange wine,* 1 *pint. Dissolve, first the citric acid, and then the sulphate of quinine, in the wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter.*

The following *unofficial preparations* may be noted :—

QUINIDINÆ SULPHAS — Sulphate of Quinidine, $C_{20}H_{24}N_2O_2H_2SO_42H_2O$ (Conquinine Sulphate of Hesse, Chinidine Sulphate) — (*not official*). — Given in the same doses as Quinine Sulphate, and in the same cases.

QUININA—Quinine, $C_{20}H_{24}N_2O_23H_2O$—(*not official*).—The pure alkaloid is rarely used in practice. Quinine has been used in combination with many other acids, but only to a limited extent, and they have all, after a short trial, given place to the older preparations. The following are the more important :—

QUININÆ ARSENIAS—Arseniate of Quinine—Variable formula—(*not official*).—Usually contains 66 per cent. of Quinine and 29 per cent. of Arsenious Acid.

Dose.—$\frac{1}{10}$ grain.

QUININÆ HYDROBROMAS—Hydrobromate of Quinine,

$C_{20}H_{24}N_2O_2HBr2H_2O$—(*not official*).—A neutral or slightly alkaline preparation. Soluble in water, 1 in 55.

Dose.—1 to 10 grains.

QUININÆ SALICYLAS — SALICYLATE OF QUININE — (*not official*).—Introduced to combine the properties of quinine and salicylic acid. Is soluble, 1 in 630 of water; 1 in 25 of rectified spirit; 1 in 25 of chloroform.

Dose.—2 to 10 grains.

QUININÆ SULPHAS (NEUTRAL)—NEUTRAL SULPHATE OF QUININE, $C_{20}H_{24}N_2O_2H_2SO_4.7H_2O$—(*not official*).—Introduced on account of the sparing solubility of the ordinary sulphate. Soluble in 1 in 10 water, and in 1 in 45 rectified spirit. There exists also an Acid Sulphate, $C_{20}H_{24}N_2O_22H_2SO.7H_2O$, still more soluble.

Dose.—2 to 10 grains.

QUININÆ VALERIANAS — VALERIANATE OF QUININE, $C_{20}H_{24}N_2O_2C_5H_{10}O_2.H_2O$—(*not official*).—This salt is usually prepared by double decomposition. Solubility, 1 in 150 water; 1 in 2 rectified spirit; 1 in 15 ether.

Dose.—1 to 5 grains.

QUINETUM—QUINETUM—(*not official*).—Is the name given to the mixed alkaloids from the various Cinchŏna Barks. It is sometimes called *Cinchona febrifuge.* In its solubilities it resembles Quinine Sulphate. It is oftenest found in the form of "Liquor."

Dose.—1 to 10 grains.

QUINOIDIN (*Syn.* CHINOIDIN)—QUINOIDIN.—Is the name given to the mixture of amorphous alkaloids left after extraction of the crystalline Cinchona alkaloids. It is blackish and of alkaline reaction.

Dose.—1 to 10 grains.

Therapeutics.—The chief difference between the action of cinchona bark and its alkaloids lies in the astringency of the former, which is due to the presence of cincho-tannic acid. As tonics, these preparations are given in small doses, and are employed as bitter stomachics in cases of debility, especially when this condition is produced or attended by profuse discharges, such as colliquative sweating or diarrhœa, or by other mucous or purulent discharges, such as leucorrhœa, abscesses, &c. They are useful in cases of physical exhaustion, whether produced by chronic disease or as met with in convalescence from acute attacks, provided there be not febrile, inflammatory, or active hemorrhagic symptoms, and no great irritability of the stomach or bowels. As antiperiodics, the cinchona preparations are much less frequently employed than the alkaloids, in consequence of the bulk in which they must be given, and the disagreeable topical irritant effects which they produce; for this purpose quinine, as a rule, possesses all the qualifications, with none of the disadvantages, of the barks. On the alkaloids alone depend the antiperiodic and febrifuge properties of the bark, and as they are identical in action, and differ only in degree, quinine, being the most powerful, may be taken as their type in considering their physiological action.

Locally, quinine and its salts tend to irritate, and if too frequently repeated, or in too large dose, they may cause gastric catarrh, nausea, vomiting, or diarrhœa. They are also antiseptic, preventing or averting putrefaction and fermentation. Quinine acts essentially in the same manner on all forms of contractile tissue—stimulating in small doses, and in larger doses completely paralysing, and causing rigor mortis. It stops the heart in diastole.

Internally quinine and its preparations act as gastric and general tonics, antipyretics, and antiperiodics, but have not the astringent properties of the barks. Sulphate of quinine is more extensively employed than any other of the preparations of cinchona, as a tonic, antiperiodic, and febrifuge, and excepting astringency and aromatic flavour, it possesses all the valuable properties of the barks themselves, with the additional great advantage of being equally potent in smaller doses. When given in large doses, or in moderate doses long continued, quinine gives rise to symptoms to which the name cinchonism, or quininism, has been applied. The more prominent of these symptoms are—dulness of hearing, giddiness, singing, hissing, or buzzing in the ears; fulness, tension, and pain in the head; flashes of light across the eyes, and nausea. If the dose be larger, or repeated, the cerebral symptoms are more completely developed; there is vertigo, a staggering gait, the difficulty of hearing is increased; there may be perverted vision or total blindness, the face flushed, the fulness in the head may be relieved by epistaxis, and delirium and coma may ensue in extreme cases. After toxic doses, death appears to result from paralysis of the heart and respiratory centres. Occasionally an eruption, followed by desquamation, has been noticed after the administration of quinine, and in elderly people it sometimes causes irritability of the bladder and kidneys.

In small doses ($\frac{1}{2}$ to 2 grains) it is largely used as a tonic in atonic dyspepsia, debility, convalescence, phthisis, &c.

As an antipyretic in fevers it may be given in small divided doses, or better, in one large dose—10–20–30 grains. It lowers the temperature satisfactorily, but in such quantities is always to a certain extent depressing, as it depresses the nervous system, and lessens reflex excitability and the general bodily metabolism.

The most important of its actions is the power it has over malarial fever, both as a prophylactic and curative agent. To explain this action various theories have been advanced. Thus M. Piorry, in 1846, asserted that quinine arrested a paroxysm of malarial fever by an action on the spleen, diminishing its size, &c. This idea is, however, erroneous, because the splenic enlargement is not the cause of the fever paroxysm, but a result; besides, quinine does not appreciably diminish the enlarged organ when given in these cases. Then Binz brought forward his theory of its action on the blood corpuscles, and inferred that quinine acted as a chemical antidote to the malarial poison. Probably its action is germicidal. In intermittents the administration should be begun 6 or 8 hours before the attack is due, and continued in hourly doses for 3 or 4 hours, until 15 to 30 grains have been given. In the intervals treatment is continued with smaller doses. *As a prophylactic*, the dose is 3 grains given in the morning, and if the district is very unhealthy, the same dose may be repeated in the evening.

As a curative agent it is in the simple and uncomplicated forms of intermittent fevers that quinine and the cinchona preparations are most serviceable; in remittent fevers they are less efficacious. In other *regularly-recurring* disorders, such as neüralgia, tic-douloureux, headache, and many others, the cinchonas and quinine are useful. Quinine is also used in the treatment of continued and other fevers, especially in typhoid and typhus fevers, when pyrexia is present; under such conditions, it exerts a decidedly lowering effect on the temperature without materially influencing the general course of the fever. To be most effectual, the dose should be large. It has also been extensively tried in fevers of septic origin, such as puerperal fever; but the balance of evidence seems to allow it no true antiseptic powers, but simply an antipyretic action, and even that, according to Landau, who tried it freely in this class of diseases, is only of a very temporary nature. In scarlatina, small-pox, erysipelas, in dysentery, in carbuncle, and many other rapidly-exhausting diseases, the antipyretic action is disappointing. In certain cachectic conditions, as in secondary syphilis, in scrofulous eye affections and skin disease, in conjunction with other remedies, quinine or the barks are often of essential service. In enlargement of the spleen, and many other disorders, these remedies are employed, especially if they are of malarious origin.

Cinchonine and cinchonidine possess medicinal properties similar to those of quinine and its salts, and may be employed in the same circumstances. Cinchonine salts are usually considered to be only about two-thirds as efficacious as those of quinine, so that, for the same effect, they required to be administered in proportionately larger doses. Cinchonidine possesses properties similar to those of cinchonine, but is less powerful.

Dose and Administration.—Quinine may be given by the stomach, rectum, or subcutaneously. In intermittent fever, the dose and time of administration depend on the severity of the attack. In mild cases, give first a mercurial purge, then 10 grains about five hours before the expected paroxysm, and the same dose in the sweating stage, or it may be administered in smaller divided doses. If the case be very severe, give a larger dose, 20 to 40 grains at once, without waiting for intermissions. The cure is frequently expedited by giving arsenic in the intervals of the paroxysm. As a stomachic tonic ¼ to 2 grains, as a nervine tonic 1 to 3 grains in pill or solution with dilute sulphuric or hydrobromic acid, and tinct. aurantii. As an antiperiodic, 10 to 30 grains given in cachets or rice paper, in coffee or milk, or in bolus with chocolate.

For hypodermic injection solutions of the bisulphate, hydrochlorate, or hydrobromate are suitable.

Adulterations or Substitutions of Cinchona, &c.—Cinchona bark is not now much adulterated, but occasionally bad varieties of bark appear in the market; these can be easily detected by estimating the percentage of alkaloid by the method already mentioned. The salts of quinine are not now so subject to adulteration as formerly, but the salts of the other alkaloids have been found mixed with them, as occasionally also salicin (detected by the meadow-sweet odour which it gives when heated with dilute sulphuric acid and red chromate of potassium), cane and milk sugars (detected by boiling with dilute sulphuric acid and Fehling's solution, when the latter is reduced), the fatty acids (detected by the smell on heating on a strip of platinum foil), calcium sulphate, and boracic acid, which are easily found out by their chemical tests. The microscope is also an important means in detecting impurities.

Cephaëlis Ipecacuanha—The Ipecacuanha Plant.

IPECACUANHA—*Ipecacuanha*—*Ipecacuan*—*Poaya.*—The dried root of *Cephaëlis Ipecacuanha*, A. Rich. (*C. emetica*, Pers.; *Callicocea Ipecacuanha*, Brot.; *Ipecacuanha officinalis*, Arruda.)

Collection, &c.—The collection is carried on all the year round, and the collectors are called Poayeros. The roots are pulled up by the hand, being relieved from below by a pointed stick pushed into the ground. Parts of the roots are left in the ground, and from these new roots arise. They are dried in the sun as rapidly as possible, and when ready are broken into pieces 3 or 4 inches long, and freed from sand and earth. The plant flowers in November and March.

Characters.—In more or less twisted pieces, usually from 2 to 4 inches long, and about the size of a small writing quill.[1] It consists of two parts, viz., a central inert, whitish, woody axis, and a thick cortical or active portion which is brownish, greyish-brown, or reddish-brown, irregularly annulated,[2] and having a resinous or waxy fracture. Taste, somewhat acrid and bitter,[3] odour slight and peculiar, more especially when powdered.

Dose.—As an expectorant—$\frac{1}{2}$ to 2 grains; as an emetic—15 to 30 grains.

Carthagena or New Granada Ipecacuanha is like the above, but it is thicker, and has a greater development of its medullary rays, is not so much annulated, and is not so rich in *Emetine.*

[1] The root of *Psychotria emetica* is much thicker. [2] This annular condition is peculiar to *Ipecacuanha*, and none of its adulterants possess it. [3] The spurious Ipecacuanhas are most of them sweet.

Active Principles.—Contains *resin*, *fat*, *albumin*, *various sugars*, *gum*, a very large amount of *pectin* and a *fœtid volatile oil.* Most important of all is *Emetine* or *Emetia*, the active alkaloidal principle, $C_{28}H_{40}N_2O_5$ (1 to 3 per cent.), combined with *Ipecacuanhic Acid.* *Emetine* may be obtained from the dried powdered root by mixing it with milk of lime and exhausting the mixture with chloroform or petroleum ether, when it is obtained as a white powder, turning brown on exposure to light and softening at 70° C. It gives an intense permanent yellow colour with solution of chlorinated lime and acetic acid. It is sparingly soluble in water, but freely in alcohol and chloroform, not so freely in ether, oils, or benzol. Dilute acids dissolve it freely, and form with it non-crystalline salts. *Ipecacuanhic Acid*, $C_{14}H_{18}O_7$, is a bitter glucoside, and gives a green colour with $FeCl_3$.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Acetum.	No. 20 powder.	1 in 20.	5 to 40 minims.
Pilula Ipecacuanhæ cum Scilla.	Fine powder.	1 in 23.	" "
Pulvis Compositus.	" "	1 in 10.	5 to 15 grains.
Trochisci.	" "	$\frac{1}{4}$ grain in each lozenge.	1 to 3.
[1] Trochisci Morphinæ et Ipecacuanhæ.	" "	$\frac{1}{12}$ grain in each lozenge.	1 to 6.
Vinum Ipecacuanhæ.	Coarse "	1 in 20.	5 to 40 minims as an expectorant, 3 to 6 fluid drachms as an emetic.

[1] Will be found under Morphine. Also contained in *Pilula Conii Composita* (1 in 6 nearly).

ACETUM IPECACUANHÆ—VINEGAR OF IPECACUANHA.—*Take of ipecacuanha in No.* 20 *powder,* 1 *ounce; dilute acetic acid sufficient for* 20 *fluid ounces. Moisten the powder with a suitable quantity of the menstruum and macerate for* 24 *hours; pack in a percolator, and gradually add the acid until the required volume of the vinegar of ipecacuanha is obtained.*

PILULA IPECACUANHÆ CUM SCILLA—PILL OF IPECACUANHA WITH SQUILL.—*Take of compound powder of ipecacuanha,* 3 *ounces; squill in powder, ammoniacum in powder, of each,* 1 *ounce; treacle, a sufficiency. Mix the powders, and beat into a mass with the treacle.*

PULVIS IPECACUANHÆ COMPOSITUS—COMPOUND POWDER OF IPECACUANHA—PULVIS IPECACUANHÆ CUM OPIO—DOVER'S POWDER.—*Take of ipecacuanha, in powder,* $\frac{1}{2}$ *ounce; opium, in powder,* $\frac{1}{2}$ *ounce; sulphate of potash, in powder,* 4 *ounces. Mix them thoroughly, pass the powder through a fine sieve, and finally, rub it lightly in a mortar. Keep it in a stoppered bottle.*

This powder, when allowed to stand for a lengthened period of time, is apt to have the heavy potassium sulphate settle to the bottom. It should, therefore, be shaken up each time before being used.

TROCHISCI IPECACUANHÆ—LOZENGES OF IPECACUANHA.—*Take of ipecacuanha, in powder,* 180 *grains; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce, or a sufficiency. Mix the powders, and add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains a quarter of a grain of ipecacuanha.*

VINUM IPECACUANHÆ—WINE OF IPECACUANHA.—*Take of ipecacuanha, coarsely powdered,* 1 *ounce; acetic acid,* 1 *fluid ounce; distilled water, a sufficiency; sherry,* 1 *pint. Macerate the ipecacuanha in the acetic acid for* 24 *hours. Transfer to a percolator and pass sufficient distilled water through to produce* 1 *pint of liquor. Evaporate the product to dryness over a water-bath. Powder the residue and macerate it in the sherry for forty-eight hours with occasional agitation and filter.*

This wine differs materially from that of the *Pharmacopœia* of 1867. It is so far an improvement in that the root is thoroughly exhausted, but the prolonged heat necessary to make a dry extract destroys a certain proportion of the *emetine.* It would be better if a standardised Liquid Extract were introduced from which the wine could be at once made.

SYRUPUS IPECACUANHÆ ACETICUS—ACETIC SYRUP OF IPECACUANHA, *B.P.C.*—(*not official*).—*Take of vinegar of ipecacuanha,* 1 *pint; refined sugar,* $2\frac{1}{4}$ *pounds. Dissolve by the aid of a gentle heat. Specific gravity about* 1·33.

Dose.—$\frac{1}{4}$ to 2 fluid drachms.

TINCTURA IPECACUANHÆ—TINCTURE OF IPECACUANHA—(*not official*).—*Take of bruised ipecacuanha,* 1; *proof spirit,* 10. *Macerate for eight days, then press and make up to* 10.

Dose.—5 to 40 minims as an expectorant.

Incompatibles.—Salts of the heavy Metals, Vegetable Acids, and everything containing Tannin.

Therapeutics.—Ipecacuan, in the form of powder, acts as a topical irritant when applied to a sensitive membrane, as seen in some persons in whom a violent attack of spasmodic asthma is occasioned by inhalation of the finer particles. It also acts as a nauseant, emetic, expectorant, diaphoretic, and depressant. When continued in small doses it acts upon the secreting membranes of the bronchi and intestines, especially the former, facilitating expectoration, and increasing mucous secretion. In larger doses it acts as an emetic, and imparts also a sense of weariness and a tendency to sleep; in very large doses it paralyses the respiratory centre, the heart still continuing to beat. As an emetic, ipecacuan is a safe remedy, its effects being neither too depressing nor too long sustained. It is very suitable in infantile cases in which emetics are required, as in hooping-cough, in catarrh with difficult expectoration, croup, &c.; it is likewise useful in adults, especially those of debilitated constitution, to remove irritant matters from the stomach under various circumstances, but its action is slow (20 to 30 minutes), hence in poisoning, sulphate of zinc or mustard are preferable. When the skin is kept warm, it acts also as a diaphoretic. It is useful in some cases of dyspepsia and diarrhœa, either alone or in combination with opium, and small doses are given as an adjunct to purgatives in chronic constipation. Ipecacuanha is of the greatest value in the cure of acute tropical dysentery, in the treatment of which it is often given in very large doses (25 to 30 grains), by the mouth, as well as injected into the large intestine by the long tube. The large dose is to be followed by a smaller in about eight hours, provided relief is not obtained. Nausea seldom is distressing as tolerance is generally induced, but it is sometimes advisable to give 15 minims of laudanum before the ipecacuanha, to diminish the irritability of the stomach; if the first dose is rejected, the second is usually retained. In chronic dysentery it is administered in doses of 1 to 3 grains thrice a day, along with opium and mercury. Ipecacuanha was originally introduced into practice by Helvitius as a cure for dysentery, and hence was originally termed Radix Antidysenterica. The powder of ipecacuan and opium is a popular sudorific, and is employed in a variety of cases. Sometimes, given in small doses, it occasions vomiting, and it should not be given when there is much irritability of the stomach. Finely-powdered ipecacuan, made into a liniment with lard and olive-oil, and rubbed into the skin, acts as a counter-irritant, producing a vesicular eruption, which, without causing much pain, disappears in the course of two or three days.

Dose.—As an expectorant or purgative, ½ to 2 grains, as an emetic, 10 to 30 grains; children bear large doses. The wine and vinegar are now reliable preparations.

Adulterations or Substitutions.—Most important of all, perhaps, is the undue proportions of woody stems in the true Ipecacuanha Root. 1. Carthagena or New Granada Ipecacuanha has already been mentioned. 2. The root of *Psychotria emetica* or Large Striated Ipecacuanha has longitudinal furrows, and is not annulated. It has a sweet taste, and contains much sugar, and it does not give the starch reaction with iodine as does true Ipecacuanha. 3. Small Striated Ipecacuanha from a species of *Richardsonia* is smaller, is striated, grey or blackish brown, and has large dotted ducts and fine medullary rays. 4. Undulated Ipecacuanha from *Richardsonia scabra* has a knotty, undulating appearance. It is brownish externally, but has a white farinaceous appearance internally, and a sweet taste, and contains *no emetine* (see test under *Active Principles*). Others less important than the foregoing have been found in the market, but not so much lately. Their names may just be mentioned:—Indian Ipecacuanha, from *Tylophora asthmatica;* White Ligneous Ipecacuanha, from *Ionidium Ipecacuanha;* and Bastard Ipecacuanha, from *Asclepias currasavica.* They can all be proved to contain *no emetine.* Powdered Ipecacuanha has been found adulterated with starch, flour, and almond meal. The latter would appear to be a favourite adulterant, and by the microscope is detected because of its oil drops, hexagonal and oblong cells. The microscopic appearances of flour and starch are sufficient to render their detection easy.

Randia dumetorum—(*not official*).—An Indian Herb, the fruit of which is used as a substitute for Ipecacuanha.

Dose.—Of the tincture (1 in 5), 15 to 60 minims.

Naregamia alata — Naregamia — Goanese Ipecacuanha — (*not official*).—*Habitat*, Western India.

RADIX NAREGAMIÆ—NAREGAMIA ROOT.—*Active principles* are *naregamine*, *fixed-oil*, *resin*, &c. Has been used as a hepatic stimulant in the form of a tincture (1 in 8) made with proof spirit.

Dose.—5 to 15 minims. It has some emetic action also.

Rubia tinctorum, Linn.—Madder—Dyer's Madder—(*not official*).

RADIX RUBIÆ—*Madder Root.*—*Habitat,* the Levant and Southern Europe.

Active Principles are *Alizarin*, *Rubian*, *Rubihydran*, *Ruberythrin*, *Purpurin*, *tannin*, *sugar*, &c. Madder is scarcely used in medicine now, but it was at one time as an emmenagogue in $\frac{1}{2}$ drachm doses of the root made into infusion, and given four times a day. From *Alizarin* there has been prepared a brownish amorphous powder called *Anthrarobin*, said to act like *Chrysophanic Acid*, but without its irritating symptoms, and used in ointment of 10 per cent. strength. *Alizarin* is, however, chiefly prepared from *Anthracene*, $C_{10}H_{14}$, a coal-tar product.

Galium aparine, Linn.—Goose Grass—Cleavers—Bedstraw—(*not official*).—*Habitat*, indigenous.

Active Principles are *tannic acid*, *citric*, *malic*, and *rubichloric acids*, &c., and an unknown *bitter principle.*

Therapeutics.—On account of its astringency it has been used as a styptic. It is also said to possess diuretic properties, and was at one time used in scrofula and epilepsy, and as an application to chronic ulcers.

Dose.—1 to 2 drachms made into decoction. As a local application—a decoction made 2 oz. to the pint.

Coffea arabica—The Coffee Shrub.—A native of tropical Africa, common in Abyssinia. Cultivated in most tropical countries. Our largest supplies come from Ceylon.

COFFEÆ SEMINA—*Coffee Seeds.*—The dried seeds (commonly called berries) of *Coffea arabica*, Linn.—(*not official*).

Characters.—Each fruit contains two seeds enclosed in a parchment-like endocarp, from which they are separated by drying and winnowing. Before grinding, the coffee is roasted, whereby the testa is separated from the seeds.

Active Principles.—The most important is *Caffeine* (about 1 to 1·3 per cent.), already described under *Camellia Thea.* In addition it contains *Caffeotannic Acid*, *cane-sugar*, *invert sugar*, *mannite*, proteids, and a mixture of volatile substances probably developed during the roasting, which has been called *Caffeone.* The roasting of coffee is interesting from a chemical standpoint on account of the number of resulting products, among which may be named, *palmitic*, *acetic*, and *carbonic acids*, *hydrochinone*, *pyrrol*, *methylamine*, &c., to which coffee owes its aroma.

Therapeutics.—Practically that of tea. It is not so likely to disorder the stomach, and in some cases of diarrhœa and of gastric catarrh an infusion of good coffee without sugar or milk acts as a sedative to the irritated surfaces, allaying any tendency to vomiting. It has a stimulant action on the nervous system, and gives relief in migraine and nervous headache ; in cases of spasmodic asthma with severe seizures in the early morning, strong coffee sometimes cuts short the attack. It may also be used as a stimulant in narcotic poisoning. Immoderate use of coffee is said to produce palpitation, nervous tremor, &c., but it is exceedingly rare to find cases of this sort.

Adulterations or Substitutions.—The most important is Chicory detected by Pereira's test as follows :—Lay a little of the suspected *powder* gently on the surface of a glass of cold water. If chicory be present it at once colours the water, whereas if the powder be genuine it floats on the top, and does not colour it for a long time.

Nat. Ord. **VALERIANACEÆ**—The Valerian Order.—Herbs, inhabiting the temperate climates of Europe, Asia, and America. The plants possess stimulant, antispasmodic, and tonic properties, due to the presence of a strongly-smelling volatile oil; in the East many plants of the order are used as perfumes.

Official Plant.

Name.	Part Used.	Habitat.
VALERIANA OFFICINALIS.	Dried rhizome.	Indigenous.

Valeriana officinalis—The Valerian Plant—Common Valerian—All-heal.

Botany. — Herbaceous. *Root-stock*, perennial, tuberous, with numerous root-fibres from 2 to 6 inches long. *Stem*, solitary, 2 to 4 feet high, furrowed, smooth. *Leaves*, all pinnate; leaflets, seven to ten pairs, lanceolate-dentate, terminal leaflet little, if at all, larger than the others. *Inflorescence*, a corymb, becoming somewhat panicled. *Flowers*, whitish or flesh coloured. *Fruit*, smooth, compressed, one-celled, and one-seeded. *Habitat*, indigenous, commonly growing in ditches and damp places, but occasionally in dry and elevated situations. It flowers in June and July. The plant grows wild all over Britain, but is cultivated in various parts of Derbyshire. It is dug up in autumn, the rhizomes separated, washed, dried, and preserved in a dry condition.

VALERIANÆ RHIZOMA — Syn. VALERIANÆ RADIX — *Valerian Rhizome—Valerian Root.*—The dried rhizome and rootlets of *Valeriana officinalis*, Linn. (*V. sambucifolia*, Mikan, *V. angustifolia*, Tausch).

Characters and Test.—A short erect rhizome, entire or sliced, dark yellowish-brown externally, and giving off numerous slender, brittle, shrivelled rootlets, 3 or 4 inches long, of the same colour as the rhizome; rhizome and rootlets whitish internally. Odour developed in the process of drying peculiar and disagreeable;[1] taste unpleasant, camphoraceous and slightly bitter. Yields volatile oil and valerianic acid when distilled with water.

Dose in Powder.—10 to 30 grains.

[1] The odour of fresh valerian is not unpleasant.

Active Principles.—It contains *resin*, *starch*, *gum*, *sugar*, &c., but most important is the *Volatile Oil* and *Valerianic Acid*. It has been shown that the fresh plant, when distilled, yields a *neutral watery distillate* and a *faintly smelling essential oil*; but if this oil be exposed to the air, or if an alkali be added to it, it soon develops the smell of *valerianic acid*. The volatile oil consists of the alcohol borneol ($C_{10}H_{18}O$) and its ether $(C_{10}H_{17})_2O$, along with ethers of valerianic, formic, and acetic acids, which acids are gradually set free on exposure of the volatile oil to the air.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Bruised rhizome.	1 in 40 (about).	1 to 2 fluid ounces.
Tinctura.	No. 40 powder.	1 in 8.	1 to 2 fluid drachms.
„ Ammoniata.	„ „	„ „	½ to 1 fluid drachm.

INFUSUM VALERIANÆ—Infusion of Valerian.—*Take of valerian rhizome, bruised,* ¼ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA VALERIANÆ—Tincture of Valerian.—*Take of valerian rhizome, in No.* 40 *powder,* 2½ *ounces; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

TINCTURA VALERIANÆ AMMONIATA — Ammoniated Tincture of Valerian.—*Take of valerian rhizome, in No.* 40 *powder,* 2½ *ounces; aromatic spirit of ammonia,* 1 *pint. Macerate for seven days in a well-closed vessel, with occasional agitation; then strain, press, filter, and add sufficient aromatic spirit of ammonia to make* 1 *pint.*

Therapeutics.—Valerian acts as an antispasmodic, depressing the nervous system, and in large doses causing vertigo, headache, loss of vision, and reducing reflex excitability. It is useful in functional nervous cases, especially when these are complicated with hysteria. It has been recommended in typhoid fever, in typhoid pneumonia, in hysteria, diabetes, in neuralgia, in insanity, in epilepsy, &c., but is now seldom used, except in hysteria. The ammoniated tincture is said to be the best preparation.

Adulterations or Substitutions.—The plant is not in this country subject to adulteration, but plants which have been allowed to become damp in the process of drying, and are hence more or less worthless, may be substituted. This is readily detected by the faintness or absence of the valerian odour in the distillate (see *Characters and Tests*). In America the rhizome of *Sium latifolium*, Linn.—the Water Parsnip—has been found to be substituted for valerian. It is known by its aromatic odour. In this country the rhizome of *Veratrum album*—White Hellebore—has been found. It is detected by the tingling feeling which it produces on being chewed. The root of *Patrinia scabiosæfolia*, Link.—Japanese Valerian, called "Kesso"—has been offered, and chemically it differs in nothing from the indigenous variety. It has a very short root-stock with a large number of rootlets. The absence of the upright rhizome distinguishes it from *Valeriana officinalis.*

Nat. Ord. **DIPSACEÆ**—The Teasel Order—(*not official*).—Herbs or Undershrubs.

The best-known native plant of the order is **Scabiosa succisa**—The Devil's Bit, so called on account of the abrupt termination of its rhizome. It has been used to adulterate Valerian rhizome. It flowers from July to October; is found on meadows and pastures; stem and both surfaces of leaves hairy; flowers purple, blue, or white (rare); radical leaves numerous, stem leaves few; stem 1 to 3 feet high; leaves oblong entire; corolla 4-cleft and regular; calyx, 5 bristles. The rhizome yields a *green colouring substance;* and in the form of decoction has been used in domestic medicine as an astringent.

Nat. Ord. **COMPOSITÆ**—The Composite Order.—Herbs or shrubs universally distributed. The properties of the composite plant are various, most of them being more or less bitter; they may be stimulant, carminative, tonic, narcotic, laxative, anthelmintic, &c.

Official Plants.

	Botanical Name.	Parts Used.	Habitat.
Tubuliflorae.	ANACYCLUS PYRETHRUM.	Dried root.	Algeria.
	ARTEMISIA MARITIMA, *var.* STECHMANNIANA.	Dried capitula.	Russia.
	ANTHEMIS NOBILIS.	" "	Britain (cultivated).
	ARNICA MONTANA.	Dried rhizome and rootlets.	Middle and Southern Europe.
Liguliflorae.	LACTUCA VIROSA.	Flowering herb.	Britain.
	TARAXACUM OFFICINALE.	Fresh and dried roots.	"

SUB-ORDER—TUBULIFLORÆ.

Anacyclus Pyrethrum—Pellitory—Pellitory of Spain.

PYRETHRI RADIX—PELLITORY ROOT.—The dried root of *Anacyclus Pyrethrum*, DE CAND. (*Anthemis Pyrethrum*, Linn. *Anacyclus pseudo-Pyrethrum*, Ascherson).

Characters.—In unbranched pieces from 2 to 4 inches long, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch thick, cylindrical or somewhat tapering, and covered by a thick brown shrivelled bark, studded by dark coloured receptacles of resin. Breaks with a close fracture, the fractured surface presenting a radiated appearance. Inodorous, but when chewed causing a prickling sensation over the whole mouth and throat.

Active Principles.—Contains *inulin*, *starch*, *sugar*, *tannin*, *earthy salts*, *a dark brown and a yellow fixed oil*, *resin*, and an alkaloid (?) which has received the name of *Pyrethrine*.

Official Preparation.

Name.	Parts Used.	Strength.	Dose.
Tinctura.	No. 40 powder.	1 in 5.	Not given internally.

TINCTURA PYRETHRI—TINCTURE OF PELLITORY.—*Take of pellitory root, in* No. 40 *powder*, 4 *ounces; rectified spirit*, 1 *pint. Prepared by maceration and percolation.*

Rectified spirit is necessary for the solution of the resin.

Therapeutics.—Pellitory acts as a local irritant and stimulant, causing a profuse flow of saliva when chewed. It is used as a masticatory in toothache, tic-douloureux, paralysis of the tongue, rheumatic affections of the jaws, relaxation of the uvula, &c. Thirty to sixty grains of the root may be chewed at one time as a masticatory. In the *German Pharmacopœia* pellitory is used mixed with belladonna and opium in the form of pill for toothache, each pill containing about $\frac{1}{7}$th grain of the powdered root. When given in large doses it produces the symptoms of acute irritant poisoning.

Adulteration or Substitution.—On the Continent the official pellitory is replaced by the root of *Anacyclus officinarum*, which is light grey, and only half as thick, and has remains of stalks and leaves. Its properties are the same, and it is quite as good as *A. Pyrethrum*, and some regard it as only a variety of the latter. In this country the root of *Parietaria erecta*, Koch, *P. diffusa*, Koch, and *P. officinalis*, Sm., all belonging to the order *Urticaceæ*, native plants growing around old walls, are by country herbalists sold under the name of Pellitory. None of them possess the acrid taste of the official Pellitory, although they are all bitter.

Pyrethrum (Chrysanthemum) Roseum, Bieber, **P. Carneum**, Bieber—Persian Pellitory—Persian or Caucasian Insect-flowers—(*not official*).—Indigenous to Western Asia. The flowers are the parts used, and in appearance resemble chamomile, the former (*P. Roseum*) being rose-coloured, and the latter (*P. Carneum*) purple. Both have a peculiar odour and an acrid taste.

P. cinerariæfolium, Trev.—Dalmatian Insect-flowers.—Indigenous to Dalmatia, now cultivated in California.

Characters of the Flowers.—Biennial. Flower heads, an inch and a half broad. *Involucre*, imbricate, margin scarious. *Receptacle*, solid, convex, naked. Single and double flowers, and all shades from white to crimson. *Ray-florets*, ligulate and 3-toothed. *Disk-florets*, tubular. *Akenes*, brown, angular, no wings, but a short membranous pappus. *Flowering time*, April. *Wild and cultivated*, the former most esteemed.

Characters of Insect-Powder of Dalmatia.—It is coarse, yellowish-green, with a pungent odour and a very acrid taste developed a few seconds after it has been in the mouth. It is non-poisonous to the higher animals, but quickly paralyses the motor centres of insects, whereby they are stupefied and rendered motionless. It does not kill them so readily.

Active Principles.—Analyses have been made by various authors, all of them differing much. The most important constituents are said to be an *oleo-resin* (*persicein*), *an acid resin* (*persiretin*), and a soluble *glucoside Persicin* (the active agent), which with acids yields *Persiretin*. The powder from the half-open flowers is the most active.

Lately, on account of the great demand for the powder, it has been adulterated with the powdered leaves and stems ; these contain very little of the active ingredients. The powdered flowers of *P. roseum* are said to be substituted for *P. cinerariæfolium*. Kirkby has shown how, by means of the microscope, the two can be distinguished. He believes this adulteration is not often practised.

Artemisia maritima, var. **Stechmanniana**, Besser—The Santonica or Wormseed Plant.

SANTONICA—SEMEN CINEÆ—FLORES CINEÆ—SEMEN SANTONICÆ

—*Santonica Wormseed.*—The dried unexpanded flower-heads or capitula of *Artemisia maritima*, var. *Stechmanniana*, Besser (*A. pauciflora*, Weber), (*A. Lercheana*, Kar. and Kir.).

Characters.—About $\frac{1}{10}$th inch in length, oblong-ovoid, obtuse, pale greenish-brown, nearly smooth,[1] resembling seeds in appearance, but consisting of from 12 to 18 imbricated involucral scales with a broad thick yellowish-green mid-rib, enclosing 3 to 5 somewhat tubular florets. Odour, more especially when rubbed, strong, peculiar, and somewhat camphoraceous; taste, bitter and camphoraceous.

Dose.—10 to 60 grains.

[1] Barbary Wormseed is covered with a whitish down. Indian Wormseed is also hairy, and of a pale yellow colour.

Active Principles.—Contains *resin, fat, wax, sugar, malic and other acids, potassium and calcium salts*, and much *silica*, also 1 to 2 per cent. of a *volatile oil.* Most important of all is the crystalline body called *Santonin*, to be described presently.

Official Preparation.

SANTONINUM—SANTONIN, $C_{15}H_{18}O_3$.—A crystalline principle prepared from *Santonica*.

SUMMARY OF THE *B.P.* PROCESS.

A. Boil the Santonica with slaked lime and water to form a calcium salt of *Santonic Acid*, which is freely soluble.

B. Add hydrochloric acid to set free insoluble Santonin[1] (which is deposited), oily matter (which floats to the top), calcium chloride (which is soluble).

C. Skim off the oil; collect the precipitate of impure Santonin, wash with ammonia;[2] and finally with water.

D. Mix the Santonin with animal charcoal to free from colouring matter. Add rectified spirit to dissolve the Santonin; boil.

E. Filter while hot, and set in a cold dark place to crystallise.

[1] Santoninic Acid, $C_{15}H_{20}O_4$, more correctly which parts with H_2O, and Santonin is thus reproduced. [2] To remove resin, a soluble ammonium compound being formed; ammonia does *not* combine with santonin.

Characters and Tests.—Colourless flat rhombic prisms feebly bitter, fusible and sublimable when gently heated,[1] scarcely soluble in cold water, sparingly in boiling water, but abundantly in chloroform and in boiling rectified spirit. Added to warm alcoholic solution of potash it yields a violet-red colour.[2] Sunlight renders it yellow.[3] It is not dissolved by dilute mineral acids. Ignited with free access of air it burns without leaving any residue.[4]

[1] If strong heat be applied it burns with a smoky flame. [2] This is peculiar to Santonin ; the colour is transient, for the solution soon becomes transparent. [3] Blue or violet rays produce the same, but not the other spectral rays : it is said to be converted into Photo-santonic Acid ($C_{23}H_{34}O_6$). [4] Absence of foreign inorganic matter.

Dose.—2 to 6 grains.

Santonin melts at 170° C. Dissolves in alkalis forming salts of *Santonic Acid* (or *Santoninic*), from which acids reprecipitate the Santonin. It is soluble in fixed oils, in 5000 parts of cold and 250 parts of boiling water ; in 40 parts of cold alcohol ; and in 2·7 parts of alcohol at 80° C. ; in 72 parts of cold, and in 40 parts of boiling ether ; and in 4 parts of cold chloroform. Hesse believes santonin to be really *Santonic Anhydride.*

Official Preparation.

Name.	Strength,	Dose.
Trochisci.	1 grain in each lozenge.	1 to 6 lozenges.

TROCHISCI SANTONINI—SANTONIN LOZENGES.—*Take of santonin,* 720 *grains ; refined sugar in powder,* 25 *ounces ; gum acacia in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water, a sufficiency. Mix the santonin, sugar, and gum ; add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber at a moderate temperature. Each lozenge contains* 1 *grain of santonin.*

Therapeutics.—When santonin is given to the lower animals in large dose, it produces tremor, rigidity, opisthotonos, convulsions, salivation, and dilatation of the pupils. The urine becomes yellow, and death seems to be due to spasm of the respiratory centre. In man the vision becomes yellow, due to some change in the retina or in the central visual centre (probably the latter) ; the urine becomes yellow coloured, and is increased in amount. Nausea, vomiting, giddiness, diarrhœa, and colicky pains may be produced. The above are often brought about by doses less than the maximum. Children appear to bear the drug better than adults, but care should be exercised in the case of delicate subjects. Its great use is as an anthelmintic, being especially serviceable in killing or expelling *ascaris* and *oxyuris.* The best mode of administration is in the form of the official lozenge, or santonin itself mixed with powdered sugar or milk-sugar, given in the early morning after a light supper the previous evening, and followed in two or three hours by a full dose of castor-oil. If necessary, it may be repeated on two or three alternate mornings. The dose for an adult is 1 to 6 grains; for children 1 grain may be given for each year of the child's life up to 4 or 5 grains. Santonin has been used in a very limited way in whooping-cough and as a diuretic, and in atrophic inflammation of the choroid and retina, the doses being somewhat large. Santonica is seldom employed in this country, but it may be given in 10 to 60 grain doses in honey or treacle.

Adulteration or Substitution.—Santonica is seldom adulterated, but Barbary and Indian Wormseeds have already been noticed. American Wormseed is said to be often sold for the official santonica, but it is easily detected. Its seed is lenticular in shape, obtuse at the edge, brown-black and glossy; it has a turpentine odour and a bitter pungent taste. Santonin is said to have been adulterated with boric acid (its alcoholic solution gives a green colour to flame) and starch (rendered blue by iodine). Santonin which has been exposed to sunlight resembles picric acid, but the aqueous solution of the latter precipitates gelatin and stains organic tissues yellow, while santonin does neither. Colourless santonin resembles somewhat acetanilide (antifebrine), but the latter is soluble in about 200 parts of cold water, and freely so in spirit, ether, benzol, and chloroform; and, when heated with solution of potash and a few drops of chloroform, it develops the unpleasant odour of phenyl-isonitrile.

Artemisia Absinthium—Absinthium officinale—Wormwood—(*not official*).—*Habitat*, indigenous. Wormwood tops and leaves, from native plants, gathered in July and August, are used.

Characters.—*Leaves*, pubescent, hairy, grey-white, tripinnatisect, bipinnatisect, or pinnatisect. *Stems*, furrowed, covered with adpressed silky hairs. *Flowers*, about 40 in a head, outer row, female; inner, bisexual or male; corollas yellow; all tubular.

Active Principles.—Contains *tannin, resin, starch, albumin, malic and succinic acids.* The most important constituent is a *volatile oil* which gives the odour to the plant, and which consists of *Absinthol*, $C_{10}H_{16}O$, and one or more *terpenes.* The bitterness is due to *Absinthin*, a body which has not yet been obtained in a pure state.

Therapeutics.—The oil, in large or in repeated small doses, produces in man and the lower animals a kind of chronic intoxication; and, if further pushed, convulsions follow. The herb distilled with spirit forms a beverage called absinthe, used especially in France and in some parts of America, and producing the effects above mentioned when taken in large doses. Wormwood is a feeble anthelmintic, and is occasionally given in domestic medicine. It possesses in a small degree anti-malarial properties, and has been employed in ague. As a tonic and stomachic it is good, and is much used in some districts, but more as a domestic remedy than in regular practice. It may be given in the form of infusion (½ ounce to the pint), in 1 to 2 ounce doses as a tonic, and in 5 ounce doses as an anthelmintic.

Anthemis nobilis — Chamomile — True Chamomile — Roman Chamomile.

Botany.—Herbaceous, perennial. *Root,* spindle-shaped, smooth, dark-brown externally, white within. *Leaves,* radical, runcinate, broad, dentate, glabrous, bright shining green. *Scape,* simple, erect, with a single head of flowers of a golden-yellow colour. *Fruit,* yellow, somewhat compressed. *Habitat,* indigenous, in fields and waste places. *Flowers* from June to September.

ANTHEMIDIS FLORES—*Chamomile Flowers.*—The dried single and double flower heads or capitula of *Anthemis nobilis,* Linn. (*Chamomilla nobilis,* Godr.; *Ormenis nobilis,* J. Gay). From cultivated plants.

Characters.—The single chamomile flowers of commerce are those in which the capitula have some yellow tubular florets in the centre, surrounded by a variable number of those which are white and ligulate; the double flowers are those in which all or nearly all the florets are white or ligulate. In both kinds the receptacle is solid, conical,[1] and densely covered with chaffy scales; and both varieties, but especially the single, have a strong aromatic odour and very bitter taste.

[1] This distinguishes it from the various species of Matricaria, which have flat receptacles.

Chamomile grows wild in various parts of England and Ireland, and is especially found around London growing in gravelly and sandy places. It is said not to be indigenous to Scotland. Our chief supplies are from Mitcham in Surrey, where the plant is largely cultivated. The flowers are dried by artificial heat.

Active Principles.—Contains a *bitter principle,* soluble in water and alcohol, not yet obtained pure, and a *volatile oil* of which the plant yields from 0·6 to 0·8 per cent. In addition *fixed oil*, *grape-sugar*, *tannin*, *albumin*, *gum*, *wax*, &c., have been found.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Extractum.	Dried flowers and oil.	...	2 to 10 grains.
Infusum.	Dried flowers.	1 to 20	1 to 4 fl. ounces.
Oleum.	"	...	1 to 4 minims.

EXTRACTUM ANTHEMIDIS—EXTRACT OF CHAMOMILE.—*Take of chamomile flowers*, 1 *pound; oil of chamomile*, 15 *minims; distilled water*, 1 *gallon. Boil the chamomile with the water until the volume is reduced to one-half, then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the oil of chamomile at the end of the process.*

This is a long and tedious process. The oil is added at the end to make up for the loss of volatile oil during evaporation. It is possible that quite as good an extract could be prepared by maceration and percolation with one-fourth the volume of proof spirit, distilling off the alcohol and evaporating further in a vacuum.

INFUSUM ANTHEMIDIS—INFUSION OF CHAMOMILE.—*Take of chamomile flowers*, $\frac{1}{2}$ *ounce; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for fifteen minutes, and strain.*

It is infused for fifteen minutes *only*, in order to have as little as possible of the volatile oil vaporised.

OLEUM ANTHEMIDIS—OIL OF CHAMOMILE.—The oil distilled in Britain from chamomile flowers.

Characters.—Pale-blue or greenish-blue, but gradually becoming yellowish-brown; with the peculiar odour and aromatic taste of the flowers.

The single flowers yield most oil, and are the best for medicinal purposes, but there is a prejudice in favour of double flowers. The specific gravity of the oil is about 0·900. It contains the butyl and amyl ethers of valerianic, angelic, and tiglinic acids, besides hydrocarbons.

Therapeutics.—Chamomile acts as an aromatic bitter tonic, and was formerly also esteemed as a febrifuge. It is chiefly used in the present day as a domestic medicine for the treatment of simple atonic dyspepsia; the extract is a useful adjunct to purgative medicines in the form of pill. A strong tepid infusion is sometimes given to promote the action of emetics; the infusion is also used externally as a fomentation to relieve pain and swelling, but the best form of external application is a poultice made with the flowers.

Adulterations or Substitutions.—The single flowers (sometimes called Scotch Chamomile flowers) may be confounded with, or have had substituted for them those of *Anthemis* (or *Maruta*) *Cotula*, Linn., called Maruta or Cotula or Mayweed, which has, however, an elongate-conical receptacle, a fœtid odour, and an acrid taste; *A. arvensis*, or Corn Chamomile, with a conical receptacle, but the ray florets always have styles; *Matricaria Chamomilla*, Linn., or Wild Chamomile, with a hollow, naked, conical receptacle; *M.* (or *Pyrethrum* or *Chrysanthemum*) *Parenthium*, Linn., or Feverfew, with a convex naked receptacle. The double flowers, also called English Chamomile flowers, have to be distinguished from those of cultivated Feverfew, *M. Parenthium*, which have a convex but not quite naked receptacle, as in the single variety. The florets are all ligulate, however, and this distinguishes it. On the whole it perhaps, more than any other flower, resembles chamomile. *Achillea Ptarmica*, Linn., or Sneezewort, has short round rays, no odour, and an acrid taste. All the above are more fully described further on. The oil may be adulterated with alcohol and wax. The volatile oil of German Chamomile has a much more powerful odour, a higher colour, and a higher specific gravity, being at least 0·930.

Matricaria Chamomilla—Wild Chamomile—German Chamomile—(*not official*).

Botany.—Annual. *Leaves*, bipinnate, smooth, segments capillary, simple or divided. *Heads*, solitary, and on long naked stalks. *Receptacle*, hollow, conical. *Involucre*, nearly flat. *Stem*, erect, foot or so high, branched. *Disk*, yellow. *Ray*, white. *Habitat*, indigenous. *Grows* on cultivated and waste ground. *Flowers* in June and July.

The *active principles*, in addition to *tannin*, *extractives*, &c., are a *volatile oil*, at first blue, but gradually turning green, and a *bitter substance*.

Therapeutics.—Mostly used in domestic medicine in the same manner as the official chamomile, but it is much less agreeable.

Matricaria (*Syns.* Pyrethrum, Chrysanthemum) **Parenthium**, Linn., Feverfew—(*not official*).

Botany.—*Perennial. Involucre*, convex. *Leaves*, stalked, pinnate, segments ovate or oblong. *Receptacle*, convex. *Fruit*, crowned with a short jagged membrane. *Stem*, erect, 2 feet high, branched. *Heads*, in small corymbs terminating the stem and branches. *Disk*, yellow. *Ray*, white. *Habitat*, indigenous; waste places. *Flowers* in July and August.

Of the *active principles* little is known beyond that they resemble those of the former plant, a *greenish volatile oil*, and a *bitter principle*, &c. It is chiefly used in domestic medicine as a tonic bitter.

Achillea Millefolium, Linn.—Yarrow—Millefoil—(*not official*).

Botany.—Perennial. Stem, erect, 6 to 18 inches high, nearly glabrous or woolly. *Leaves*, with a lanceolate outline, bipinnatifid, woolly or nearly glabrous, rachis entire or subdentate, with entire teeth. *Inflorescence*, a dense corymb, rays about half as long as the involucre. *Heads*, small. *Florets*, white, occasionally red or purplish. *Habitat*, indigenous on pastures and waste grounds. *Flowers* from June till August.

Active Principles.—Resin, gum, &c., a *volatile oil*, a bitter principle *Achilleïn*, and an acid *Achilleïc Acid*.

Therapeutics.—Tonic, but said to have particularly an action on the pelvic viscera, hence has been given in piles and painful menstruation. Used in the form of decoction 1 in 20, and 1 to 2 ounces for a dose. The *dose* of Achilleïn is 8 to 10 grains.

Achillea Ptarmica, Linn.—Sneezewort—(*not official*).

Botany.—Perennial. Stem, erect, branched, 2 feet high. *Leaves*, shining, linear lanceolate, attenuated, serrated. *Inflorescence*, compound corymb. *Florets*, white. *Disk*, broad, white. *Habitat*, indigenous, moist meadows and thickets. *Flowers* in July and August.

The flowers have been employed in the same cases as chamomile, but to a very limited extent, and only as a domestic remedy.

Anthemis (*Syn.* Maruta) **Cotula**—Maruta—Mayweed—(*not official*).

Botany.—Annual. Stem, 1 to 2 feet high, branched, angular, furrowed. *Leaves*, bipinnatifid, nearly glabrous, lobes linear acute, mostly entire. *Inflorescence*, terminal. *Receptacle*, elongate, conical. *Disk*, yellow. *Ray*, white, *without* styles. *Tube* of corolla two-winged. Whole plant fœtid and acrid. *Habitat*, indigenous, fields and waste places. *Flowers* from July till September.

The *active principles* are much the same as in the official Chamomile, but in addition the plant contains *Valerianic Acid* ($HC_5H_9O_2$). The whole plant is sometimes used, but the flowers are most esteemed, and in the same cases and doses as chamomile.

Tussilago farfara—Coltsfoot—(*not official*).—Official in the *P.G.*

Botany.—Perennial. Flowers appear before the *leaves* in bright, yellow, solitary heads, erect in blossom and seed, their stalks clothed with smooth scale-like bracts. *Ray-florets,* narrowly-ligulate, pistillate. *Disk,* florets tubular, staminate. *Inflorescence,* terminal capitula. *Leaves,* roundish-cordate, angular toothed, downy beneath. *Rhizome,* creeping, 12 to 18 inches long, branching, $\frac{1}{8}$ inch thick, with joints, and of a grey-brown colour. *Habitat,* indigenous; moist clay and chalky soils; often seen on railway banks. *Flowers* in March and April.

The *active principles* are *mucilage, tannin, bitter principle,* &c.

Therapeutics.—Has been recommended in pulmonary affections, such as bronchitis, and in addition it has had some repute in scrofulous conditions. The dried leaves and flowers may be smoked or made into infusion, 1 to 20, *dose,* 1 to 2 fluid ounces.

Inula Helenium (Covisartia Helenium) — Elecampane — (*not official*). Official in *P.G.*

INULÆ (Enulæ-Helenii) RADIX—*Root of Elecampane.*—The dried root of *Inula Helenium,* Linn. *Habitat,* indigenous, but not native to Scotland.

Characters.—The fresh root is about 6 inches long and 1 to 2 inches thick, and divided into branches of about 5 to 10 inches long and about $\frac{1}{2}$ inch thick. It is very fleshy. In commerce the root has the following characters :—Found either in longitudinal or transverse slices, and twisted or curled from contraction during drying. Mixed with these may be seen portions of the entire root. The colour is brown externally, and grey-brown internally. It breaks with close smooth fracture. When chewed there is at first no distinct taste, but it soon in the mouth becomes aromatic, bitter, and slightly pungent. The odour is agreeably aromatic, and somewhat like orris root.

Active Principles.—Wax, tannin, resin, bitter substance, &c., but the most important are :—*Inulin,* having the same composition as starch, $C_6H_{10}O_5$, but iodine turns it yellow, and boiling with water converts it into levulose, $C_6H_{12}O_6$. The odour and taste are due to a *volatile oil,* which contains *Alantol,* $C_{20}H_{32}O$, a body having a peppermint odour and taste, *Alantic Anhydride,* $C_{15}H_{20}O_2$, and *Helenin* (Elecampane-camphor), C_6H_8O, an insipid body.

Therapeutics.—Is now seldom used, although lately helenin has been employed as an antiseptic lotion, and also internally in bronchitis and diarrhœa ($\frac{1}{3}$ to 2 grains) to diminish secretion, in amenorrhœa, and in bladder catarrh.

Calendula officinalis — Calendula-Marigold — (*not official*).—Official in the U.S.P.

Calendulæ Flores—*Flowers of Calendula or Marigold.*

Characters.—Terminal heads about 2 inches broad, with a hemispherical involucre with two rows of linear-lanceolate scales. Re ceptacle, flat without scales. Ray-florets in one or more rows, pistillate and strap-shaped, $\frac{5}{8}$ inch or more long, and about $\frac{1}{8}$ inch wide, veined and 3-toothed at apex, yellow or orange-coloured. Disk-florets numerous, tubular, 5-cleft, yellow, staminate, and barren. Sunlight bleaches the florets.

The whole plant is used in medicine, and contains, besides *tannin*, *gum*, &c., a *bitter amorphous body* unnamed, and *Calendulin*, a yellow, tasteless substance of which little is known.

TINCTURA CALENDULÆ FLORUM — Tincture of Calendula, B.P.C.—(*not official*).—*Take of marigold flowers, dried in No.* 20 *powder*, 4 *ounces ; proof spirit, sufficient. Made by maceration and percolation, and then made up to* 20 *fluid parts.*

Therapeutics.—The tincture is locally .applied in bruises, contusions, sprains, &c. It is seldom given internally, although said to be alterative.

Grindelia robusta—Grindelia—Gum Plant—Rosin Weed—(*not official*).—Official in the U.S.P.—Indigenous to Mexico and some parts of North America.

Grindeliæ Folia et Cacumina—*Leaves and Flowering Tops of Grindelia.*

Little is known of the *active principles* beyond that a *volatile oil*, *resin*, *and bitter principle* are present.

EXTRACTUM GRINDELIÆ FLUIDUM—Fluid Extract of Grindelia, B.P.C.—(*not official*).—*Made with dilute alcohol to represent* 1 *in* 1.

Therapeutics.—Little is known of the physiological action of grindelia, but it has antispasmodic and expectorant actions, and in large quantities greatly depresses the nervous system. It is used with success in asthma, in chronic bronchitis, and in whooping-cough. One drachm of the fluid extract in 4 to 6 ounces of water, used as a dressing, has given relief in dermatitis from rhus toxicodendron and other irritants ; the dose in asthma is 10 to 30 minims repeated every half-hour or hour.

Arnica montana—The Arnica Plant—Mountain Tobacco.

ARNICÆ RHIZOMA—*Syn.* ARNICÆ RADIX—*Arnica Rhizome—Arnica Root.*—The dried rhizome and rootlets of *Arnica montana*, Linn. (*Doronicum montanum*, Lam.).

Characters.—Rhizome cylindrical, dark-brown, from 1 to 2 inches or more in length, and from $\frac{1}{6}$ to $\frac{1}{4}$[1] inch in diameter, contorted, rough from the scars of fallen leaves, some remains of which are usually to be found at its upper end, and giving off from its under surface[2] numerous dark-brown filiform wiry rootlets. Odour, peculiar and somewhat aromatic. Taste, acrid and bitterish.[3]

[1] This is half as thick again as the root of *Geum urbanum*. [2] *Geum urbanum* has rootlets on all sides. [3] *Geum urbanum* is astringent.

ARNICÆ FLORES—*Arnica Flowers*—(*not official*).

Characters.—In heads of 1 to 2 inches in diameter surrounded by an involucre of a double equal row of scaly bracts. Receptacle flat, pitted, chaffy, bearing 15 to 20 bright-yellow pistillate, 3-toothed ligulate ray-florets about 1 inch long, and numerous tubular 5-tooth bisexual disk-florets. The achenes are brown, hairy, linear-oblong, strongly striate longitudinally, crowned by a pappus of fine yellow hairs. The odour is aromatic, and the taste acrid and bitter.

Chemistry.—Besides *wax*, *resins*, *gum*, &c., the root contains a *volatile oil*, and *arnicin*, a yellow amorphous body freely soluble in alcohol and ether, slightly in water. The flowers also contain *arnicin* and a *volatile oil*, the latter being greenish and differing somewhat from that found in the root.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Tincture.	Powdered rhizome.	1 in 20.	$\frac{1}{2}$ to 1 fluid drachm.

TINCTURA ARNICÆ—TINCTURE OF ARNICA.—*Take of arnica rhizome, in No.* 40 *powder,* 1 *ounce; rectified spirit,* 1 *pint. Prepared by maceration and percolation.*

Therapeutics.—Arnica acts in over-doses as an acro-narcotic, producing a burning sensation in the throat, nausea, vomiting, purging, vertigo, &c. In medicinal doses it has been classed with stimulants, diaphoretics, narcotics, and in its external application, with deobstruents. It is highly esteemed in some parts of the Continent, but has not met with the same acceptance in this country, although it has been lauded by homœopathists. As an internal remedy it has been recommended in adynamic fevers and asthenic inflammations, in paralytic and nervous affections, in amaurosis, in chronic rheumatism, and in other cases in which debility and inactivity are remarkable, its use being contra-indicated in cases in which there is a tendency to sthenic inflammation, internal congestion, or hemorrhage. In this country it is little, or not at all, used for such purposes. Externally, it is extensively employed as an application to sprains, bruises, ecchymoses, &c., and has received the significant appellation of *Panacea lapsorum.* It may be applied in the form of tincture or lotion, but it requires to be used with caution, as it may produce sometimes an eczematous or erysipelatous inflammation, especially in people with delicate skins. Preparations made from the flowers are preferred by some.

Adulteration.—The root of *Geum urbanum*, as previously mentioned.

SUB-ORDER—LIGULIFLORÆ.

Lactuca virosa — The Lettuce Plant — Wild Lettuce — Acrid Lettuce.

Botany.—*Stem*, erect, round, marked with blood-red spots. *Leaves*, horizontal, obtuse, arrow-shaped at the base. *Root*, tap-shaped. The herb attains a height of 2 to 4 feet, has yellow flowers in numerous heads, stalked, ½ to ¾ inch wide, with several small bracts below arranged in spicate cymes. *Involucre*, oblong, imbricate, in two or three rows, glabrous, greenish. *Receptacle*, flat and naked. *Flowers*, few in each head, bisexual. *Corolla*, strap-shaped, 5-toothed at the end. *Anthers*, broad at the apex. *Style*, hairy, bifid. Larger than the common garden lettuce, and the entire plant is filled with a fetid milky juice. It is an indigenous biennial, flowers in August and September, and is found abundantly in the hedgerows.

LACTUCA—*Lettuce.*—The flowering herb of *Lactuca virosa*, Linn.

Official Preparation.

Extractum, ... Dose, 5 to 15 grains.

EXTRACTUM LACTUCÆ—EXTRACT OF LETTUCE.—*This is a green extract made in the same way as extract of aconite.*

LACTUCARIUM—LETTUCE OPIUM—(*not official*).—Is the inspissated juice of both varieties of lettuce, *L. virosa* being generally preferred. Lettuce opium is usually met with in small lumps, irregular in shape, friable, reddish-brown, sometimes covered with an ash-grey efflorescence, has somewhat the odour of opium, and a bitter taste. The variety obtained from *L. sativa* is often met with in larger pieces, occasionally weighing several ounces.

Dose.—5 to 15 grains.

Chemistry.—The extract and inspissated juice contain *Lactucin*, $C_{11}H_{12}O_3 . H_2O$, and *Lactucic Acid*, both bitter, and reddened by alkalis. *Lactucerin* or *Lactucon* (about 50 per cent. in lactucarium) in tasteless crystals, *Lactucopicrin*, amorphous and bitter, *gum*, *resin*, *sugar*, *caoutchouc* and *salts* are also present. The alkaloid *Hyoscyamine* has also been described as a constituent.

Therapeutics.—Preparations of lettuce have a mild hypnotic, narcotic, anodyne, sedative, and antispasmodic action. They may be used as a substitute for opium in cases in which the objections to that drug are insuperable, but their action is very uncertain. They are chiefly employed for their sedative effect in bronchitis with exhausting cough. The fresh herb is also slightly soporific.

Taraxacum officinale—The Dandelion Plant—Taraxacum.

Botany.—Herbaceous, perennial. *Root*, spindle-shaped, smooth, dark-brown externally, white within. *Leaves*, radical, runcinate, broad, dentate, glabrous, bright shining green. *Scape*, simple, erect, with a single head of flowers of a golden-yellow colour. *Fruit*, yellow, somewhat compressed. *Habitat*, indigenous, in fields and waste places. Flowers from March to November.

The varieties of Taracum are numerous, and by De Candolle they were named as distinct species, as—*T. lævigatum*, *T. erythrospermum*, *T. obovatum*, *T. palustre*, *T. leptocephalum*.

TARAXACI RADIX—*Dandelion Root*—*Taraxacum Root.*—The fresh and dried roots of *Taraxacum officinale*, Linn. (*T. Dens-leonis*, Desf.; *T. vulgare*, Schrank; *Leontodon Taracum*, Linn.; *L. officinale*, With.; *L. vulgare*, Lam.). Collected in the autumn from indigenous plants.

Characters.—Root, when fresh, frequently a foot or more in length, and half an inch or more in diameter, smooth and yellowish-brown externally, whitish within. It breaks readily with a short fracture, and a milky juice exudes; the fractured surface presenting faint concentric rings.[1] When dried it is more or less shrivelled, deeply furrowed longitudinally, dark-brown or blackish, breaks with a short fracture, and the exposed surface shows a yellow[2] porous central woody axis, surrounded by a thick whitish bark, with a variable number, according to its size, of irregular well-marked concentric rings. Inodorous; taste bitter.

[1, 2] These are very characteristic of Dandelion root, and distinguish it from almost every possible substitution.

Active Principles.—It contains a crystalline bitter principle, *Taraxacin*, *Taraxacerin*, $C_8H_{16}O$, an *acrid resin*, *colouring matter*, &c. *Inulin* is present in large amount (24 per cent.) in autumn, but in spring *Levulin* and *Sugars* take its place.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Dried root bruised.	1 to 20.	2 to 4 fluid ounces.
Extractum.	Fresh root.	...	5 to 30 grains.
„ Liquidum.	Dried root in No. 20 powder.	1 in 1.	$\frac{1}{4}$ to 2 fluid drachms.
Succus.	Fresh root.	3 in 4.	1 to 2 fluid drachms.

DECOCTUM TARAXACI—DECOCTION OF DANDELION.—*Take of dried dandelion root, sliced and bruised,* 1 *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

EXTRACTUM TARAXACI—EXTRACT OF DANDELION.—*Take of fresh dandelion root,* 4 *pounds. Crush the root; press out the juice, and allow it to deposit; heat the clear liquor to* 212° F. (100° C.), *and maintain the temperature for ten minutes; then strain, and evaporate by a water-bath at a temperature not exceeding* 160° F. (71°·1 C.), *until the extract has acquired a suitable consistence for forming pills.*

This is practically the same process as for a Green Extract, but here there is no chlorophyll to be separated and added.

EXTRACTUM TARAXACI LIQUIDUM—LIQUID EXTRACT OF DANDELION.—*Take of dandelion root, in* No. 20 *powder,* 40 *ounces; proof spirit,* 4 *pints; distilled water, a sufficiency.*

This extract is another example of a "Valoid." (See Extractum Cocæ Liquidum for details of preparation and explanation.)

SUCCUS TARAXACI—Juice of Taraxacum.—*Take of fresh dandelion root, 7 pounds; rectified spirit, a sufficiency.*

The directions and explanations mentioned under Succus Conii apply to this preparation.

Therapeutics.—Taraxacum acts as a bitter tonic, stimulating the secretions of the alimentary canal, and thus improving appetite and digestion. It is given in dyspepsia and all atonic conditions of the stomach, while its prolonged administration is found to be useful in torpor of the bowels. It is reputed to increase biliary secretion, but incorrectly.

Adulterations or Substitutions.—The root of Common Hawkbit (*Leontodon hispidum*, Linn.) may be occasionally substituted. In the fresh state it is tough, breaks with difficulty, and has little or no juice. Chicory root (*Cichorium Intybus*, Linn.) has a lighter colour, thinner bark, and radiating milk-vessels, and the taste is more bitter. The roots of the various Docks (Rumex) are not unlike dandelion root, but the former are lighter in colour, more tapering, more irregular in size, there is little juice, and the whole root is fibrous. None of them have the ringed appearance and yellow central axis of dandelion.

In America the various preparations of dandelion are said to be often replaced by those of chicory.

Cichorium Intybus, Linn.—Chicory—Succory—(*not official*).—Indigenous to Britain.

Botany.—Perennial. *Stem*, 3 to 4 feet high. *Leaves*, oblong or lanceolate. *Flower-heads*, maxillary clusters. *Florets*, 5-toothed, whitish or blue, ligulate. Flowers from June to October. The root—the part used—to be collected in late autumn or early spring. *Root*, several heads, 10 to 12 inches long, branched, wrinkled longitudinally, brown externally, white internally. The bark is thin, white, and separated from the yellow porous wood by a brown cambium line. It has no odour, and has a bitterish, agreeable taste. When powdered and laid on the surface of a glass of water it readily stains the water brown. (This distinguishes it from *ground coffee.*)

The *active principle*, besides *inulin*, *sugar*, &c., is a *bitter principle*, which has not been fully examined.

Therapeutically, chicory has been used as a substitute for dandelion. Its bitter principle has a tonic action on the gastric glands, and it is said to benefit cases of malaria. It may be used in infusion. It is often mixed with coffee to impart a bitter flavour.

Nat. Ord. **OLEACEÆ**—The Olive Order.—Trees or shrubs inhabiting temperate climates. The plants of the order possess emollient, laxative, bitter, tonic, or febrifugal properties.

Official Plants.

Botanical Name.	Part Used.	Habitat.
FRAXINUS ORNUS.	Concrete saccharine exudation.	Calabria and Sicily.
OLEA EUROPÆA.	Oil expressed from ripe fruit.	South of Europe.

Fraxinus Ornus—Manna Ash—Flowering Ash.

MANNA—*Manna.*—A concrete saccharine exudation obtained by making transverse incisions in the stem of cultivated trees of *Fraxinus Ornus*, Linn. (*Ornus europæa*, Pers.).

Collection.—The trees are cultivated for the purpose of obtaining manna. When about eight years old they begin to yield, and continue doing so for some ten years longer. The incisions are made in July and August, and a clear liquid exudes, which soon hardens. Different parts of the stem are incised systematically in different years.

Characters and Tests.—In stalactitic pieces varying in length and thickness, flat or concave on their inner surface ; of a pale yellowish-brown colour, irregularly convex, and nearly white externally. This manna, which is known as flake-manna, is crisp, brittle, porous, crystalline in structure, and readily soluble in about 6 parts of water. Odour faint, resembling honey ; taste sweet and honey-like, combined with a slight acridity and bitterness. It consists principally of mannite, $C_6H_6(OH)_6$, together with common sugar and indefinite matter. The mannite, which forms from 60 to 80 per cent. of the manna, may be extracted by boiling with 16 parts of rectified spirit, from which it will afterwards separate on cooling in colourless, shining crystals. It requires 5 parts of cold water for its solution, and this does not undergo vinous fermentation in contact with yeast.[1] Manna contains about 10 per cent. of moisture.

Dose.—60 grains to 1 ounce.

[1] This shows absence of glucose or cane-sugar (but under certain circumstances it is fermentable).

Chemistry.—As mentioned in the B.P. description, *Mannite* forms the greater portion of manna. *Glucose, mucilage, resin,* and *Fraxin,* $C_{32}H_{36}O_{20}$, a glucoside, are also present.

Therapeutics.—Manna acts as a mild laxative, although in large doses it is liable to cause griping and flatulence. It is generally used for children, and may be given boiled in milk, or eaten as a sweet, or combined with senna or other purgative.

Adulterations, &c.—Artificial productions made of honey, sugar, and some mild purgative have occasionally been substituted. Many other species of *Fraxinus* yield mannas. Tamarisk manna, from *Tamarix mannifera,* is collected by the monks of Mount Sinai as an industry, and is a mixture of cane-sugar, glucose, dextrin, and other substances. Some species of *Eucalyptus, Pinus,* and other trees also yield saccharine exudations, which are sometimes called manna.

Olea europæa—The Olive Tree.

OLEUM OLIVÆ—*Olive Oil.*—The oil expressed from the ripe fruit of *Olea europæa,* Linn. (*O. oleaster,* Hoffm. and Link; *O. lancifolia,* Moench; *O. gallica,* Mill).

The tree is about 10 to 30 feet high, and evergreen; the fruit is a drupe about ½ to 1 inch long. The oil is obtained from it by pressure, the first yield being the finest—*virgin oil.* It is extensively cultivated in Italy, France, Spain, Portugal, Algiers, &c., and various kinds of oil occur in commerce, being known as Provence, Florence, Spanish, &c. The first-named is most esteemed. The unripe fruit, preserved in brine, is eaten as an appetiser and to "clean the palate."

Characters.—The oil is pale-yellow or greenish yellow, with a very faint agreeable odour, and a bland oleaginous taste; congeals partially at about 36° F. (2°·2 C.).

Dose.—1 to 8 drachms.

Chemistry.—When olive oil is exposed to a low temperature, it separates into a fluid portion (about ⅔) and a solid portion (about ⅓). The former consists of *Olein* (*triolein* more properly), $C_3H_5(O.C_{15}H_{33}O)_3$; the latter of *Palmitin,* $C_3H_5(O.C_{16}H_{31}O)_3$, a very small amount of *Arachin,* $C_3H_5(O.C_{20}H_{39}O)_3$, and probably also *Stearin,* $C_3H_5(O.C_{18}H_{35}O)_3$, all these being compounds of glyceryl with the respective fatty acids, and being readily split up by saponification. A trace of *Cholesterin* is also present. The oil is soluble in ether, 1 in 2, freely in chloroform, slightly (the cholesterin) in rectified spirit.

Official Preparations in which Olive Oil is used :—

Charta Epispastica	(1 in 8, about)
Emplastrum Ammoniaci cum Hydrargyro	(1 in 103, ,,)
,, *Hydrargyri*	(1 in 71, ,,)
,, *Picis*	(1 in 27, ,,)
,, *Plumbi*	(1 in 2, ,,)
,, *Saponis Fuscum*	(1 in 10½, ,,)
Enema Magnesii Sulphatis	(1 in 17, ,,)
Linimentum Ammoniæ	(3 in 4)
,, *Calcis*	(1 in 2)
,, *Camphoræ*	(4 to 1, about)
Unguentum Cantharidis	(6 to 8, ,,)
,, *Hydrargyri Compositum*	(3 in 13½, ,,)
,, ,, *Nitratis*	(8 to 15¾, ,,)
,, *Veratrinæ*	(1 to 7½, ,,)

All these will be found under their own headings. *Sapo durus* and *S. mollis* are also made with olive oil, and it is one of the sources of glycerine and oleic acid.

Therapeutics.—Externally olive oil is used as an emollient and as a constituent of ointments ; it is added to enemata, and is given in cases of irritant poisoning, exerting a soothing action. Taken internally, it is a mild, painless laxative. It is not much given as a medicine, but used in cooking and as salad oil it forms a not unimportant article of diet.

Adulterations.—Poppy-seed, cotton-seed, and other cheaper oils are often added to it. These remain fluid at a lower temperature than 36° F. Copper is sometimes added to give the greenish tint.

Soaps.—Three soaps are official, *Sapo animalis*, *S. durus*, and *S. mollis*, but lead plaster and some liniments are also chemically soaps. They are made by boiling fats with soda or potash, or some other base ; the alkali or *lye* is gradually added to the fat, and combines with the fatty acids, glycerine being set free. The soap is precipitated by adding sodium chloride to the solution, and the glycerine is recovered.

Chemistry.—All soaps are salts of the fatty acids ; those made with soda or potash are soluble in water, the others are insoluble. They mostly contain a little glycerine, and about 12 per cent. of water. If the soap contains too much water it is apt to be sodden, if too little it is hard and dry, and does not lather readily. They generally have an excess of alkali, and hence tend to irritate the skin. To obviate this, superfatted soaps in which uncombined fat is present are now largely used, but they are rather apt to become rancid from decomposition of the free fats. A good soap for ordinary toilet purposes should be neutral, or nearly neutral, in reaction, should lather easily, should not contain excess of water, and any colouring or perfumery agents added should be harmless.

Sapo Animalis—Curd Soap.—A soap made with soda and a purified animal fat consisting principally of stearin.

Characters and Tests.—White, or with a very light-greyish tint; dry; nearly inodorous;[1] horny and pulverisable when kept in dry warm air. Easily moulded when heated. Soluble in rectified spirit.[2] Soluble also in hot water,[3] the solution being neutral or only faintly alkaline to test-paper.[4] It does not impart a greasy stain to paper.[5] Incinerated it yields an ash which does not deliquesce.[6]

[1] Absence of rancid fats. [2] Indicates absence of starch, clay, flour, silicate, &c. [3] Absence of insoluble soap, &c. [4] Showing only a trace of free alkali. [5] Absence of unsaponified fat. [6] Absence of potash salt.

Preparations containing Curd Soap.

Emplastrum Resinæ .... (1 in 19)
,, *Saponis* .... (1 in $7\frac{1}{5}$)
,, ,, *Fuscum*.. ....
Extractum Colocynthidis Compositum.................. ....
Linimentum Potassii Iodidi cum Sapone ....(1 in $7\frac{1}{4}$)
Pilula Phosphori .... (1 in $3\frac{1}{10}$)
Pilula Scammonii Composita....(1 in 6)
Suppositoria Acidi Carbolici cum Sapone....(1 in $1\frac{1}{4}$, about)
,, *Acidi Tannici cum Sapone*........ (1 in 2, ,,)
,, *Morphinæ cum Sapone*........ (1 in 2, ,,)

EMPLASTRUM SAPONIS—Soap Plaster.—*Take of curd soap,* 6 *ounces; lead plaster,* $2\frac{1}{4}$ *pounds; resin,* 1 *ounce. To the lead plaster, melted at a low temperature, add the soap and resin, first liquefied; then, constantly stirring, evaporate to a proper consistence.*

Contained in *Emplastrum Calefaciens* (1 in $3\frac{1}{8}$, about).

EMPLASTRUM SAPONIS FUSCUM—Brown Soap Plaster—*Syn.* EMPLASTRUM CERATI SAPONIS.—*Take of curd soap in powder,* 10 *ounces; yellow wax,* $12\frac{1}{2}$ *ounces; olive oil,* 1 *pint; oxide of lead,* 15 *ounces; vinegar,* 1 *gallon. Boil the vinegar and oxide of lead together by the heat of a steam-bath, constantly stirring them until the oxide has combined with the acid; then add the soap and boil again until most of the moisture is evaporated; finally add the wax and oil melted together, and stir the whole continuously, maintaining the heat until, by the evaporation of the remaining moisture, the product has acquired the proper consistence for a plaster.*

Sapo Durus—Hard Soap—Syn. *White Castile Soap.*—Soap made with olive oil and soda.

Characters.—Greyish-white,[1] dry,[2] inodorous; horny and pulverisable when kept in dry warm air; easily moulded when heated. Soluble in rectified spirit.[3] Soluble also in hot water, the solution being neutral or only faintly alkaline to test-paper.[4] It does not impart a greasy stain to paper.[5] Incinerated, it yields an ash which does not deliquesce.[6]

[1] Absence of colouring agents such as ferric oxide, &c., which are found in some Castile soaps. [2] Absence of excess of water. [3] Showing that clay, chalk, &c., are not present. [4] Absence of excess of alkali. [5] Showing no uncombined oil. [6] Absence of potash and glycerine.

Official Preparations containing Hard Soap.

Linimentum Saponis,	1 in 10, about
Pilula Aloes Barbadensis,	1 in $4\frac{1}{8}$
,, ,, *et Asafœtidæ*,	1 in 4
,, ,, *Socotrinæ*,	1 in $4\frac{1}{8}$
,, *Cambogiæ Composita*	1 in 3, about
,, *Rhei Composita*,	1 in 8 ,,
[1] ,, *Saponis Composita*,	1 in 5 ,,
,, *Scillæ Composita*,	1 in $6\frac{1}{4}$

[1] *See under Opium.*

LINIMENTUM SAPONIS—LINIMENT OF SOAP—*Syn.* OPODELDOC.—*Take of hard soap, in fine shavings,* 2 *ounces; camphor,* 1 *ounce; oil of rosemary,* 3 *fluid drachms; rectified spirit,* 16 *fluid ounces; distilled water,* 4 *fluid ounces. Mix the water with the spirit, and add the oil of rosemary, the soap, and the camphor. Macerate for seven days at a temperature not exceeding* 70° *F.* (21°·1 *C.*), *with occasional agitation, and filter.*

Sapo Mollis—SOFT SOAP.—Soap made with olive oil and potash.

Characters.—Yellowish-green, inodorous, of a gelatinous consistence, soluble in rectified spirit, not imparting an oily stain to paper.[1] Incinerated, it yields an ash which is very deliquescent.[2]

[1] Absence of uncombined fat. [2] Showing potassium salt.

Soft soap contains all the glycerine liberated in its manufacture, and this in great measure accounts for its softness. Soft soap is sometimes known as *S. viridis*, green soap. It is contained in *Linimentum Terebinthinæ* (2 in 21).

Therapeutics.—Soap acts internally as an antacid in the manner of the alkalies, but is never given as such except in an emergency, as acid poisoning. Hard and curd soap are useful excipients for pills and suppositories. Externally, along with a hot bath, it (soft soap especially) softens the epidermis, and is thus often used as a preliminary to parasiticide treatment in scabies, favus, &c. Its action on the skin is always more or less irritating, but when repeatedly rubbed into a part it is especially so, and hence it is used in weak alcoholic or watery solutions as a stimulant and deobstruent in chronic skin diseases with thickening and exudation. Soap liniment is applied to bruises, sprains, rheumatic pains, &c., as a deobstruent and counter-irritant; soap plaster is useful in the same way, and affords mechanical support to the part in addition.

Dissolved in water it is employed as an enema, the soapy alkaline solution increasing peristalsis, and also softening and disintegrating hard fæcal masses. The superfatted soaps are of value for tender, irritable skins.

Acidum Oleicum—Oleic Acid.—A fluid fatty acid, $HC_{18}H_{33}O_2$, obtained by the saponification of olein, or by the action of superheated steam on fats with subsequent separation from solid fats by pressure. Usually not quite pure.

Characters.—A straw-coloured oily liquid, nearly odourless and tasteless, with faint acid reaction.[1] On exposure to air it becomes brown, and decidedly acid.[2] Specific gravity, 0·860 to 0·890. It is insoluble in water, but readily soluble in alcohol, chloroform, and ether. At 40° to 41° F. (4°·5 to 5° C.) it becomes semi-solid, melting again at 56° to 60° F. (13°·3 to 15°·5 C.). It should be completely saponified when warmed with potassium carbonate, and an aqueous solution of the salt neutralised by acetic acid and treated with acetate of lead should yield a precipitate which, after washing with boiling water, is almost entirely soluble in ether.[3]

[1] Showing only a trace of the lower fatty acids. [2] Due to the absorption of oxygen and formation of the lower fat acids. [3] This test proves the absence of more than traces of palmitic and stearic acids.

Uses.—Oleic acid is used to make oleates and as a solvent. It is less greasy than the ordinary fats, and is readily absorbed by the skin.

Official Preparations made with Oleic Acid.—Oleatum Hydrargyri and Oleatum Zinci.

Oleatum Hydrargyri—Oleate of Mercury.—*Take of yellow oxide of mercury,* 1 *ounce; oleic acid,* 9 *ounces. To the oleic acid, kept stirred in a mortar, add gradually the oxide of mercury and triturate occasionally until it is dissolved.*

$$\underset{\text{Mercuric Oxide.}}{HgO} + \underset{\text{Oleic Acid.}}{2HC_{18}H_{33}O_2} = \underset{\text{Mercuric Oleate.}}{Hg(C_{18}H_{33}O_2)_2} + \underset{\text{Water.}}{H_2O}$$

Characters.—A light-brown oleaginous semi-solid substance composed of oleate of mercury[1] and oleic acid, and having the usual slight smell of oleic acid. Gently warmed, no black precipitate separates.[2] Heated with a piece of copper-foil, the latter becomes coated with a film of metallic mercury.[3]

[1] It contains 28·4 per cent. of mercuric oxide (HgO). [2] Absence of metallic mercury. [3] Shows presence of mercury deposited on the copper.

This oleate may be prepared with half the above proportion of oleic acid, the remainder being added just before, or not long before, the oleate is dispensed.

Therapeutics.—Oleate of mercury was introduced as a substitute for ordinary mercurial ointments. It is rather more cleanly and perhaps more readily absorbed. It is used in various strengths, but for most purposes 5 or 10 per cent. diluted with oleic acid or vaseline.

Oleatum Zinci—OLEATE OF ZINC.—*Take of oxide of zinc,* 1 *ounce; oleic acid,* 9 *ounces. Stir the oxide with the oleic acid, and allow the mixture to stand for* 2 *hours; then heat on a water-bath until the oxide is dissolved.*

$$ZnO + 2HC_{18}H_{33}O_2 = Zn(C_{18}H_{33}O_2)_2 + H_2O.$$

Characters.—In yellowish masses, unctuous, and insoluble in water, or in fine white powder.

Official Preparation.

Name.	Part Used.	Strength.
Unguentum.	Oleate of zinc.	1 in 2.

UNGUENTUM ZINCI OLEATI—OINTMENT OF OLEATE OF ZINC.—*Take of oleate of zinc,* 1 *ounce; soft paraffin,* 1 *ounce. Mix by aid of a gentle heat, and stir until nearly cold.*

Therapeutics.—The ointment is used, like other zinc ointments, as a soothing application and protective in irritable skin affections. The oleate in powder is used for drying and dusting purposes.

Many other oleates, as those of Copper, Bismuth, Lead, Cocaine, Aconitine, &c., are used, but they are not official.

The metallic oleates are best made by double decomposition.

Glycerinum—GLYCERINE.—A sweet principle, $C_3H_5(HO)_3$, obtained by reaction of fats and fixed oils with aqueous fluids, and containing a small percentage of water.

Chemistry.—Glycerine in combination with fatty acids forms the ordinary fixed oils and fats. These are decomposed by caustic alkalies, lead oxide, or by superheated steam, and the glycerine is subsequently separated pure by distillation or other means. Chemically, it is a triatomic alcohol, and is known as *glycerol.*

Characters.—A clear colourless fluid, oily to the touch, without odour, of a sweet taste; freely soluble in water and in alcohol. When decomposed by heat, it evolves intensely irritating vapours.[1] Specific gravity, about 1·250.[2] Its solution is not affected by nitrate of silver,[3] sulphydrate of ammonium,[4] oxalate of ammonium,[5] or chloride of calcium,[6] and does not alter the colour of blue or red litmus paper moistened.[7] Shaken with an equal volume of sulphuric acid, no coloration, or only a slight straw colour, should result.[8] When gently heated with diluted sulphuric acid, no rancid odour should result.[9] It sometimes contains arsenic, due to impure sulphuric acid, which is often used in its manufacture.

[1] Due to acrylic acid, $C_3H_4O_2$. [2] Absence of water. [3] Absence of chlorides. [4] Absence of iron and arsenic. [5] Absence of calcium salts. [6] Absence of sulphates or oxalates. [7] Absence of acids and alkalies. [8] Absence of dextrose and cane sugar. [9] Absence of fatty acids.

Official Preparation.—Suppositoria Glycerini.

SUPPOSITORIA GLYCERINI—GLYCERINE SUPPOSITORIES.—*Take of gelatine, cut small,* ½ *ounce; glycerine, by weight,* 2½ *ounces; distilled water, a sufficiency. Place the gelatine in a weighed evaporating dish, with sufficient water to cover it, let it stand for a minute or two, then pour off the excess of water and set aside till the gelatine is quite soft, after which add the glycerine. Dissolve on a water-bath, and evaporate till the mixture weighs* 1560 *grains. Pour into moulds of* 30, 60, 120 *grains or other capacity. Each suppository contains* 70 *per cent. of glycerine.*

Glycerine is contained in the following, each of which will be found under the heading of its most important constituent:—*Extractum Cinchonæ Liquidum; Glycerinum Acidi Carbolici—Acidi Gallici—Acidi Tannici—Aluminis—Amyli—Boracis—Plumbi Subacetatis—Tragacanthæ; all Lamellæ; Linimentum Iodi—Potassii Iodidi cum Sapone; Mel Boracis; Pilula Aloes et Myrrhæ—Rhei Composita—Saponis Composita; Tinctura Kino; Unguentum Iodi.*

Therapeutics.—Glycerine has an affinity for water, and undiluted is irritating to the skin and mucous membranes; when mixed with two or more parts of simple or medicated water it keeps the skin moist, prevents chapping, and acts as an excellent emollient. It is thus applied in skin diseases, chapped hands, and dryness of the skin, tongue, mouth, or other mucous membranes; when added to lotions also, it prevents evaporation and keeps the parts longer moist. It is antiseptic to a certain extent, and being also an excellent solvent, has been largely used in pharmacy as a menstruum; owing to its sweet taste and high specific gravity, it is also used as a flavouring and suspensory agent for mixtures. Given internally it is slightly purgative; in doses of 1 to 4 drachms it has been given as a substitute for codliver oil, but is of little nutritive value. It is given as an emollient in pharyngeal, laryngeal, and bronchial catarrh to lessen cough and irritation. In diabetes it has been used as a sweetening agent, but saccharin has now largely taken its place.

When 1 or 2 drachms is injected into the rectum it acts as a purgative, the bowels being moved shortly afterwards; glycerine suppositories are the most convenient form of administration for this purpose.

Adulterations and Impurities.—Arsenic is not infrequently found. Water, mucilage, cane and grape sugar can all be readily detected by the B.P. tests.

Nat. Ord. **LOBELIACEÆ**—The Lobelia Order.—Lactescent herbs or shrubs, inhabiting tropical and sub-tropical climates. The plants generally contain an acro-narcotic milky juice, and are frequently poisonous. Named after Lobel, botanist to James I.

Official Plant.

Botanical Name.	Part Used.	Habitat.
Lobelia inflata	Dried flowering herb.	North America.

Lobelia inflata—Indian Tobacco—Bladder-podded Lobelia.

Lobelia—*Lobelia.*—The dried flowering herb of *Lobelia inflata,* Linn. (*Rapuntium inflatum,* Mill).

Characters.—Usually in compressed oblong rectangular packages, weighing from ½ to 1 pound each, and wrapped in sealed and labelled papers. The separate pieces are of varying lengths, yellowish-green, angular, and bearing sessile or stalked hairy oval irregularly-toothed leaves, together with some flowers and fruits. Odour somewhat irritating ; taste at first mild, but, after chewing, burning and acrid, causing a flow of saliva. Lobelia is sometimes found in commerce uncompressed.

The remains of the pale-blue flowers further serve to distinguish the plant, while the seeds are also characteristic ; the latter have a brownish colour, are very small (about $\frac{1}{30}$ inch long by $\frac{1}{75}$ broad), and when magnified appear oval in shape with longitudinal and transverse surface markings. The fruit is inflated, and the whole plant has a tobacco-like odour.

Dose.—Of the powder 1 to 5 grains, as an expectorant ; larger doses are emetic and very depressing.

Active Principles.—The plant contains a liquid volatile alkaloid, *Lobeline*, very poisonous and easily decomposed ; slightly soluble in water, soluble in alcohol, ether, and chloroform. A body, *Lobelacrin*, has also been described as the cause of the acridity, but this substance has been stated to be a compound of *lobelic acid* and *lobeline*. A volatile odorous body, *Lobelianin*, possibly an essential oil, is also present. The seeds contain about 30 per cent. of a fixed oil.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Tinctura.	No. 40 Powder.	1 in 8.	10 to 30 minims.
Tinctura Ætherea.	Coarse Powder.	1 in 8.	10 to 30 minims.

TINCTURA LOBELIÆ—TINCTURE OF LOBELIA.—*Take of lobelia in No. 40 powder, 2½ ounces ; proof spirit, 1 pint. Prepared by maceration and percolation.*

TINCTURA LOBELIÆ ÆTHEREA—ETHEREAL TINCTURE OF LOBELIA.[1]—*Take of lobelia in coarse powder, 2½ ounces ; spirit of ether, 1 pint. Prepared by maceration.*

[1] This is the only ethereal tincture in the B.P. It is said to contain more lobelacrin than the simple tincture, and also to be more active as an antispasmodic, but this may be due to the combined ether.

Therapeutics.—Lobelia acts in small doses as a depressant, diaphoretic, and expectorant ; in larger doses, as an effectual nauseating, depressing emetic, hence sometimes called *Emetic Weed*, but its employment as such is extremely inadvisable and even dangerous. In over-doses the nausea and vomiting are very distressing ; purging also attends its action in these cases, and extreme depression ensues, accompanied by perspiration, narrowing of pupil, sopor, and preceded by headache, vertigo, and muscular tremors. In excessive doses it acts as an acro-narcotic poison, the symptoms already mentioned are more fully developed, and death is not unfrequently preceded by convulsions. Lobelia is chiefly employed in spasmodic asthma, hooping-cough, &c., and in those cases in which tobacco, which it resembles in effect though it does not act so powerfully, has been recommended. It should, however, only be given at the commencement of the attack, as it is of no use in the interval, and it soon loses its effect by repetition. It has been given as an emetic in croup and other cases, but its nauseating and depressing effects are too powerful and too long-continued to admit of safe use in children's complaints: and, indeed, in any case its action must be carefully watched, as it occasionally causes dangerous symptoms of depression of the heart's action.

Antidotes.—The stomach should be freely washed out, and the collapse combated with ammonia and alcoholic stimulants.

Adulterations.—It does not appear to be ever adulterated.

Sub-Class III. Corolliforæ.

Nat. Ord. **VACCINIACEÆ**—The Cranberry Order.—Shrubs or small trees, natives of temperate regions (*not official*). The fruit of *Vaccinium oxycoccus*, Linn., is the British cranberry; *Oxycoccus macrocarpus*, Linn., is the American cranberry; *Vaccinium myrtillus*, Linn., is the bilberry or blaeberry of Scotland; *V. uglinosum*, Linn., is the black whortleberry; *V. Vitis-Idæa*, Linn., is the red whortleberry or cowberry. The leaves of the last have been used to adulterate bearberry leaves. They are all slightly diuretic, and discolour the urine, which contains bodies probably similar to those found after the administration of bearberry.

Nat. Ord. **ERICACEÆ**—The Heath Order.—Shrubs or small trees with entire evergreen leaves, widely diffused. Some of the plants are astringent and diuretic in action, others are narcotic and poisonous.

Official Plant.

Botanical Name.	Part Used.	Habitat.
Arctostaphylos Uva-ursi.	Dried leaves.	Indigenous.

Arctostaphylos Uva-ursi—Bearberry—Uva-ursi.

Botany.—A small evergreen procumbent shrub. *Stem*, woody, round, and trailing. *Leaves*, coriaceous, alternate, stalked, evergreen, obovate, entire shining, upper surface dark-green, under surface paler and reticulated. *Flowers*, in small terminal racemes ; corolla rose-coloured. *Fruit*, a globose, scarlet berry, having a sharp astringent taste, and containing rarely more than four or five fully developed, more or less cohering, seeds. *Habitat*, indigenous ; rugged stony districts of Europe, Asia, and America. It flowers in May, and the berries are ripe in autumn.

UVÆ URSI FOLIA—*Bearberry Leaves.*—The dried leaves of *Arctostaphylos Uva-ursi*, Sprengel (*A. officinalis*, Wimmer ; *Arbutus Uva-ursi*, Linn.). From indigenous plants.

Characters and Tests.—Very shortly stalked, obovate or spathulate, coriaceous, from ½ to ¾ inch long, smooth and shining on the upper surface, paler coloured and minutely reticulated beneath ; margins entire [1] and slightly revolute. Odour faintly tea-like when powdered,[2] taste very astringent and bitter. The infusion gives a bluish-black precipitate [3] with perchloride of iron.

Dose.—20 to 60 grains.

[1] The leaves of Vaccinium Vitis-Idæa, cowberry, have a serrated margin, and [2] have not this odour. [3] Presence of tannic acid.

Active Principles.—The leaves contain about 30 per cent. *tannic acid*, and a small quantity of *gallic acid; Arbutin*, $C_{12}H_{16}O_7$, and *Methyl-arbutin*, $C_{13}H_{18}O_7 . H_2O$, are also present. The former, when isolated, is in acicular crystals, bitter and hygroscopic, soluble in hot water and in alcohol ; when in contact with the ferment emulsin, or heated with dilute mineral acids, it splits up into hydroquinone and glucose. *Ericolin*, $C_{34}H_{56}O_{21}$, a bitter glucoside soluble in water and alcohol, and *Urson*, $C_{20}H_{32}O_2$, a crystalline neutral body, are also found.

Official Preparation.

Name.	Parts Used.	Strength.	Dose.
Infusum.	Leaves bruised.	1 to 20.	1 to 2 ounces.

INFUSUM UVÆ URSI—INFUSION OF BEARBERRY.—*Take of bearberry leaves, bruised,* ½ *ounce ; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

Incompatibles.—Salts of the heavy metals and alkaloids are precipitated by the tannin ; arbutin is decomposed by mineral acids.

Therapeutics.—Uva-ursi, in consequence of the tannic acid contained in the leaves, acts as a vegetable astringent ; the arbutin is split up in the body into hydroquinone, methyl hydroquinone, and glucose, and the two former of these being excreted in the urine render it antiseptic. If the urine be alkaline either before or after voiding, these bodies become oxidised, and give it a blackish colour. Bearberry is therefore astringent, antiseptic, and stimulating to the genito-urinary mucous membrane, and is also said to be diuretic. Its uses are the same as those of vegetable astringents generally, but it is especially applicable to diseases of the urinary passages of a chronic character, in which there is a more or less profuse mucous discharge, unaccompanied by any active inflammatory symptoms. In vesical catarrh, and in irritation due to calculus, some writers have observed great benefit from its use. Arbutin in 4-grain doses three or four times daily is sometimes given.

Adulterations or Substitutes.—The leaves of *Vaccinium Vitis-Idæa*, or cowberry, resemble them, but are dotted on the under surface, have a serrated margin, and no tea-like odour. The leaves of *V. uglinosum*, black whortleberry, are of a paler green colour, and hairy on the under surface ; those of the *Buxus sempervirens*, common box, are ovate, much narrower at the apex than at the base, and much darker on the upper than on the lower surface.

Gaultheria procumbens, Linn.—Wintergreen—Jersey Tea—Mountain Tea — Tea-berry — Partridge-berry — Box-berry — Spice-berry—Ground Holly—(*not official*).—*Habitat*, North America.

The leaves and oil are official in the U.S.P. The former contain the *volatile oil of gaultheria*, *tannic acid*, *arbutin*, *ericolin*, *urson* (see Uva-ursi), *resin*, *sugar*, &c. Their taste is aromatic, slightly bitter, and astringent, odour aromatic and agreeable. The volatile oil, *oil of wintergreen*, *oleum gaultheriæ*, can be obtained by distillation from the plant. It consists chiefly (about 90 per cent.) of salicylate of methyl, $CH_3C_7H_5O_3$ (a body which is made also synthetically on a large scale) and a hydrocarbon, *gaultherilene*, $C_{10}H_{16}$. It is of specific gravity 1·175, readily soluble in alcohol, and in alcoholic solution coloured dark purple by ferric chloride.

Therapeutics.—Oil of gaultheria has the antiseptic and carminative actions of essential oils, but in addition is anti-rheumatic. In acute and subacute rheumatism it is sometimes given in 10–20-minim doses, and may be added to liniments for application to rheumatic and swollen joints. It is also used in perfumery. The infusion

(1 to 20) is sometimes used as an astringent in diarrhœa, as an emmenagogue and galactagogue, and in some parts of North America as a substitute for Chinese tea.

The indigenous wintergreens belong to the genus *Pyrola*, and are *P. rotundifolia*, *media*, *minor*, and *secunda*, Linn.

Chimaphila corymbosa, Pursh. — Wintergreen — Pipsissewa — Princes Pine—(*not official*).—*Habitat*, North America and Northern Europe.

The active principles are somewhat similar to those of bearberry. Its action and applications are much the same also. The leaves and a fluid extract (1 in 1, dose 1 fluid drachm) are official in the U.S.P.

Nat. Ord. **SAPOTACEÆ**—The Sapota Order.—Trees or shrubs, many having a milky juice. They have alternate simple, entire, coriaceous, exstipulate leaves, and small hermaphrodite flowers. Natives of tropical Asia, Africa, and America.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Dichopsis Gutta and other trees of same nat. ord.	Concrete juice.	East Indian Islands.

Dichopsis Gutta—The Gutta Percha Tree.

Gutta Percha—*Gutta percha* (*Taban* in Malay).—The concrete juice of *Dichopsis Gutta* (*Isonandra Gutta*, Hook), and of several other trees of the natural order Sapotaceæ.

Collection.—It is obtained from the trunks of the trees. The Malays cut down the trees, strip off the bark, and collect the exuding milky juice in vessels, when it quickly hardens on exposure to the air. The average quantity got from a tree is said to be about 20 pounds. It is imported in pieces weighing 5 or 6 pounds, and to free it from earthy and other impurities it is either cut up small and kneaded in hot water, or dissolved in chloroform or oil of turpentine. The wasteful method of collecting the juice has extirpated the tree in some parts, as Singapore and Penang.

Characters.—In pieces of a light-brown or chocolate colour, tough, somewhat flexible, plastic above 120° F. (48°·8 C.), insoluble in water, alcohol, alkaline solutions, or dilute acids, but almost entirely [1] soluble in chloroform, and entirely so in oil of turpentine, carbon disulphide,[2] or benzol.

[1] The soluble portion is the pure gutta, its resins are insoluble.
[2] Caoutchouc only forms a soft jelly-like mass with this solvent.

Chemistry.—Pure *Gutta*, $C_{20}H_{32}$, of which it contains about 80 per cent., is a fine white powder, having much the same solubilities as pure gutta percha. *Fluavil*, $C_{20}H_{32}O$, a yellow resin, and *Albane*, $C_{20}H_{32}O_2$, a white crystalline resin, are oxidation products of it also present. There is 3 or 4 per cent. ash.

Official Preparation.

Name.	Part Used.	Strength.
Liquor.	Gutta Percha.	1 in 9 (about).

LIQUOR GUTTA PERCHA—SOLUTION OF GUTTA PERCHA.—*Take of gutta percha in thin slices,* 1 *ounce; chloroform,* 8 *fluid ounces; carbonate of lead,*[1] *in fine powder,* 1 *ounce. Add the gutta percha to* 6 *fluid ounces of the chloroform in a stoppered bottle and shake them together frequently until solution has been effected. Then add the carbonate of lead previously mixed with the remainder of the chloroform, and having several times shaken the whole together, set the mixture aside, and let it remain at rest until the insoluble matter has subsided. Lastly, decant the clear liquid, and keep it in a well-stoppered bottle.*

[1] The lead carbonate is added to bring down impurities and clarify the solution.

Used in making *Charta Sinapis.*

Therapeutics.—The solution is used as a protective for chapped hands, cuts, or abraded surfaces. Combined with medicinal agents it is applied to the skin in various chronic skin diseases, forming a coating which ensures the constant application of the drug and prevents staining of the clothes. In thin sheets it is largely used as a surgical dressing, and in thick sheets for making moulded splints, as, after being softened in hot water, it readily adapts itself to the part, and soon hardens again. For various other mechanical appliances, such as pessaries, bougies, specula, &c., it forms an excellent material, as it is not affected by the secretions or surgical lotions. It is used in making many kinds of plasters. The pure gutta is sometimes employed to stop carious teeth.

Adulterations.—The pure gutta for dental use is sometimes found mixed with gypsum or carbonate of lead. Many plants of the order yield an inferior article, but the B.P. tests are sufficient to determine the quality.

Nat. Ord. **STYRACACEÆ**—The Storax Order.—Trees and shrubs, chiefly inhabiting tropical and subtropical regions. The plants possess bitter, aromatic, or stimulant properties.

Official Plant.

Botanical Name.	Part Used.	Habitat.
STYRAX BENZOIN and other species.	Balsamic resin.	Java, Sumatra, and Siam.

Styrax Benzoin, Dry.—The Benzoin Tree.

BENZOINUM — *Benzoin* — Gum Benjamin. — A balsamic resin obtained from *Styrax Benzoin*, Dry (*Laurus Benzoin*, Houtt.; *B. officinale*, Hayne), and probably from one or more other species of Styrax.

Collection, &c.—In Sumatra benzoin is got by incising the trees when about seven years old, the trees continuing to yield for about twelve years longer. The juice exudes, hardens in the sun, and is then scraped off. What exudes during the first three years contains a large number of white tears, and is known as *superior* or *head* benzoin; during the next eight years the quality is not so good, and is known as *medium* or *belly;* when the trees, having ceased to yield, are cut down, split, and the wood scraped, *inferior* or *foot* benzoin is obtained. It is imported in masses of tears usually, sometimes in separate tears.

Characters.—In masses composed of loosely agglutinated tears, or more generally the tears are closely compacted together by a deep amber-brown, reddish-brown, or greyish-brown translucent substance.[1] In some specimens the tears are an inch or more in length, and when first broken they have an opaque milk-white appearance, so that the masses then present an almond-like character;[2] while in others the white substance is very small in amount, and the masses when broken resemble reddish-brown granite. Benzoin is very brittle,[3] softens readily by the warmth of the mouth, gives off, when heated, fumes of benzoic acid;[4] has very little taste, but an agreeable balsamic odour, resembling vanilla[5] or in some cases storax.[6] It is soluble in rectified spirit and in solution of potash.[7]

[1] The cause of this change in colour of the translucent substance

is unknown. [2] Hence often called Amygdaloid Benzoin. [3] Siam is more brittle than Sumatra benzoin. [4] Benzoin is thus a true balsam (a balsam contains benzoic or cinnamic acid). [5] Siam benzoin has this well marked. [6] This is present in the so-called Penang or Storax-smelling Benzoin. It is often of very fine quality, and has been supposed to be the product of *S. subdenticulata*, Miq., from Western Sumatra. [7] Indicate absence of impurities. Siam benzoin is more esteemed than Sumatra; the following are the chief differences between them:—Sumatra is in brown-grey mass, odour rather weak, and somewhat like storax, contains more impurities; Siam is in red-brown mass, odour agreeable and vanilla-like, more brittle than the other.

Dose.—10 to 30 grains.

Chemistry.—Benzoin consists largely (about 80 per cent.) of two, or perhaps three, amorphous *resins*, soluble in alcohol and in potash solution; there is also a varying quantity of a *volatile oil*. *Benzoic acid*, 12 to 20 per cent. or thereabouts, is present, and can be obtained by sublimation. *Cinnamic acid* and *Vanillin* are found in Siam benzoin. All these different bodies are closely allied in chemical composition.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Adeps Benzoatus.[1]	Gum resin.	1 in 50.	...
Tinctura Composita.	,,	1 in 10.	½ to 1 dr.

[1] See Adeps.

Benzoin is also contained in *Unguentum Cetacei.*

TINCTURA BENZOINI COMPOSITA—COMPOUND TINCTURE OF BENZOIN.—*Take of benzoin, in coarse powder,* 2 *ounces; prepared storax,* 1½ *ounce; balsam of tolu,* ½ *ounce; socotrine aloes,* 160 *grains; rectified spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient rectified spirit, if required, to make* 1 *pint.*

This is a modification of the preparation known by the various names of Friars', Jesuits', Wade's, Vervain's, Saint Victor's, Persian, Swedish, &c., Balsams. It is said to have been introduced by Roger Bacon, the friar.

TINCTURA BENZOINI SIMPLEX—SIMPLE TINCTURE OF BENZOIN.—B.P.C. (*not official*).—*Take of benzoin in powder,* 2 *ounces;*

rectified spirit, 1 *pint*. *Macerate for* 24 *hours with frequent agitation, then filter and add sufficient rectified spirit, if required, to produce* 1 *pint*. This tincture is used in inhalations and as a test for blood in clinical chemistry.

FUMIGATING PASTILLES (*not official*).—*Benzoin*, 16; *tolu balsam*, 4; *labdanum*, 1; *charcoal*, 48; *nitre*, 2; *tragacanth*, 1; *gum arabic*, 2; *cinnamon water*, 12—*to be made into a mass, shaped into cones, and dried at ordinary temperature.*

Acidum Benzoicum—Benzoic Acid, $HC_7H_5O_2$.—An acid obtained from benzoin and prepared by sublimation. Not chemically pure.

Preparation.—By repeated sublimation it can be obtained fairly pure, although some of the other constituents always adhere to it. It may also be prepared by mixing the powdered benzoin with slaked lime to form calcium benzoate, and decomposing the latter with hydrochloric acid. The benzoic acid can be dissolved in hot water, and purified by animal charcoal and recrystallisation. Benzoic acid of commerce is largely prepared from horses' and cows' urine; hippuric acid is isolated from the urine, and when treated with hydrochloric acid it splits up into glycocoll ($C_2H_5NO_2$) and benzoic acid. It may also be made from toluol and other coal-tar products.

Characters.—In light, feathery, crystalline plates and needles, which are flexible, nearly colourless, and have an agreeable aromatic odour, resembling that of benzoin.[1] It is sparingly soluble in water, but is readily dissolved by rectified spirit; soluble also in solutions of the caustic alkalies and of lime, and it is precipitated from these on the addition of hydrochloric acid, unless the solution be very dilute. It melts at 248° F. (120° C.), and boils at 462° F. (238°·9 C.). When heated to the last-named temperature it passes off in vapour, leaving only a slight residue.[2] It is soluble in cold water, 1 in 600, glycerine 1 in 10, freely in alcohol, ether, and chloroform.

[1] This is due to the presence of fragrant substances from the resin.
[2] Showing only a very small proportion of unsublimable matters.

Dose.—5 to 15 grains.

Official Preparation.

Name.	Strength.	Dose.
Trochisci.	$\frac{1}{2}$ grain in each.	1 to 5 lozenges.

Benzoic acid is also present in *Tinctura Camphoræ Composita* (2 grains in 1 fluid ounce) and *Tinctura Opii Ammoniata* (9 grains in 1 fluid ounce), and is used in making *Ammonium Benzoate* and *Sodium Benzoate.*

TROCHISCI ACIDI BENZOICI—BENZOIC ACID LOZENGES.—*Take of benzoic acid,* 360 *grains; refined sugar in powder,* 25 *ounces; gum acacia in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water, a sufficiency. Mix the benzoic acid, sugar, and gum, add the mucilage and water to form a proper mass. Divide into* 720 *lozenges, and dry them in a hot-air chamber at a moderate temperature. Each lozenge contains half a grain of benzoic acid.*

Sodii Benzoas—Benzoate of Sodium—Sodæ Benzoas—Benzoate of Soda, $NaC_7H_5O_2$.

Preparation.—By neutralising benzoic acid with solution of carbonate of sodium and evaporating to dryness.

Characters and Tests.—A white, obscurely crystalline or amorphous powder, inodorous, or having a faint benzoic odour, of a sweetish alkaline taste and reaction. Very soluble in water; soluble in rectified spirit, 1 in 24 (cold) or 1 in 12 (boiling). Twelve grains heated, melt, give off a benzoic odour, then char, and finally 3·68 grains remain,[1] which, dissolved in water, require 69 to 70 grain measures of volumetric solution of oxalic acid to neutralise. An aqueous solution gives a yellowish or flesh-coloured precipitate[2] with ferric sulphate or chloride.

[1] It is sodium carbonate. [2] Forming ferric benzoate, $Fe(C_7H_5O_2)_3$.

Dose.—10 to 30 grains.

Therapeutics.—Benzoin acts in the same manner as the other true balsams, and is apt to cause irritation of the stomach and bowels in susceptible persons. It acts as a stimulating expectorant and checks secretion in chronic pulmonary disorders, but in consequence is contra-indicated in acute cases. It is occasionally used by fumigation in affections of the throat, and the compound tincture is very often inhaled along with steam in laryngitis and other inflammations of the respiratory passages. The compound tincture is sometimes applied as a stimulant to flabby ulcers, and also to freshly incised wounds; in the latter case it should not be applied to the raw surface of the wound, but to the outer surface, after the edges have been carefully placed in apposition, otherwise it would prevent healing by the first intention; its effect is partly mechanical in holding the edges together and partly antiseptic. It is often used to protect tender nipples. Benzoin enters into various kinds of fumigating pastilles used in sick-rooms to overcome unpleasant odours ; it also greatly diminishes the tendency of fats to become rancid, a property of which advantage is taken in the preparation of Adeps Benzoatus. The simple tincture gradually added to rose or other similar water (1 in 10 or 20) forms a milky fluid (*lac virginis*) which is used as a cosmetic application in roughness of the skin, slight excoriations, itching, &c.

Benzoic acid is not only closely related chemically to salicylic acid, but resembles it greatly in action. Locally it is irritant, causing sneezing and heat in the mouth and stomach when swallowed. It is excreted in the urine as hippuric acid, rendering it antiseptic and acid in reaction, but in the sweat and saliva as benzoic acid. It is seldom given in genito-urinary diseases alone, but generally as benzoate of sodium or ammonium, which are not so irritating to the alimentary canal. It is given in chronic bronchial affections where there is a good deal of secretion and no fever.

Benzoate of sodium has been used in acute rheumatism with success, and may be given in the same doses as the salicylate.

Adulterations, &c.—Fragments of wood, bark, &c., are often present in gum benzoin ; they are left after solution in alcohol.

Benzoic acid may be adulterated with sugar, or may contain cinnamic acid. The former is detected by the caramel odour on burning ; the latter gives the odour of oil of bitter almonds on oxidation with potassium permanganate. Hippuric acid may be present in the acid prepared from urine ; it leaves an odour of hydrocyanic acid on fusing.

Nat. Ord. **APOCYNACEÆ**—The Dogbane Order.—*Trees or shrubs*, usually milky and acrid. *Leaves* entire, commonly opposite. *Fruit*, 1 or 2 follicles, capsules, drupes, or berries. Natives chiefly of the tropics, but there is one British genus, *Vinca*. Many are intensely poisonous, some are purgative, others tonic, and a few edible.

Official Plant.

Botanical Name.	Part Used.	Habitat.
STROPHANTHUS HISPIDUS.	Ripe seeds.	Tropical Africa.

Strophanthus hispidus—The Strophanthus Shrub—The Kombé Arrow Poison Plant.

STROPHANTHUS—*Strophanthus*—The mature ripe seeds of *Strophanthus hispidus*, D.C.—var. *Kombé*, Oliver—freed from the awns.

It is a climbing plant, reaching the tops of the highest trees, and forming festoons from tree to tree. The fruit is a follicle containing numerous seeds with plumose awns. The arrow-poison is made by pounding up the seeds and adding mucilaginous matter to make the whole adherent to the arrow-heads. The poison bears the native name of *Inée*, *Onaye* or *Onage*.

Characters.—Oval acuminate seeds about $\frac{5}{8}$ths of an inch long and $\frac{1}{8}$th inch broad, the base narrowed but blunt, the apex, when present, tapering to a fine extremity, flattened at the sides, the dorsal surface being more or less convex; greenish-fawn in colour, covered with appressed silky hairs; one side with a longitudinal ridge running from the centre to the pointed apex. Kernel white and oily, consisting of a straight embryo with two thin cotyledons surrounded by a thin albumen; odour characteristic; taste very bitter. After soaking in water the seed-coat is easily removed.

Active Principles.—*Strophanthin*, a glucoside, white crystalline, intensely bitter, insoluble ether, soluble in water and alcohol, is the only active principle. With strong sulphuric acid it gives a marked green coloration, and when boiled with dilute acid splits up into *glucose* and a crystalline body, *Strophanthidin*. *Oil*, *albumen*, *resin*, &c., are also present. An alkaloid, *Ineine*, has been described.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Tinctura.	Seeds in No. 30 powder, dried.	1 in 20.	2 to 10 minims.

TINCTURA STROPHANTHI—TINCTURE OF STROPHANTHUS. —*Take of strophanthus reduced to No.* 30 *powder and dried at* 110° *F.* (43°·3 *C.*), 1 *ounce; pure ether* (*the strophanthus may be washed with commercial ether free from alcohol and water*), *rectified spirit, of each a sufficiency. Pack the powder in a percolator and moisten it with the ether. Macerate for* 24 *hours, then allow percolation to proceed, continuing the addition of the ether until the fluid passes through colourless. Remove the marc from the percolator and dry it, gradually heating it to* 120° *F.* (48°·9 *C.*). *Again reduce it to powder, repack in the percolator, and moisten with rectified spirit. Macerate for* 48 *hours, then pour on* *successive quantities of the spirit, percolating slowly until half a pint of tincture is obtained. Dilute with rectified spirit to* 1 *pint.*

Dose of Strophanthin.—$\frac{1}{100}$ to $\frac{1}{50}$ grain.

Therapeutics.—Strophanthus belongs to the same group of remedies as digitalis (*q.v.*), with which it is almost identical in action and in therapeutical uses. It is said to act more quickly but not so persistently as the latter, to have less, or even no, effect in contracting the arterioles, and to have less tendency to accumulate in the system. Strophanthin has been given hypodermically.

Adulterations and Substitutes.—It is important to guard against unripe or inferior seeds, as the tincture made from these has little activity. The seeds of commerce often consist of a mixture derived from various species of Strophanthus, and some of these contain *Ouabain*, a glucoside having the same action as strophanthin, but probably more powerful.

Urechites suberecta—Yellow-flowered Nightshade—Savannah Flowers—(*not official*).—*Habitat*, West Indies.

It contains two glucosides, *Urechitin* and *Urechitoxin*, both extremely poisonous, and having the digitalis action. It has been used as a diuretic, &c., to a very limited extent, but its interest is mainly toxicological. It is supposed to have been the chief poison used by obeah men in Jamaica in the slavery days, when it was desired to get rid of an unpopular master.

Tanghinia venenifera.—The seeds form the Ordeal Poison of Madagascar. The active principle is a glucoside, *Tanghinin*, which has the digitalis action.

Apocynum Cannabinum—Canadian Hemp.—*Habitat*, North America.

The root contains *Apocynin* and *Apocynein*, both having the action of digitalis. It has been used as a diuretic, expectorant, and emetic.

Holarrhena antidysenterica.—*Habitat*, East Indies.

The bark is known as Conessi or Tellichessi Bark (*not official*). The seeds are also used. Two alkaloids, *Conessine* and *Wrightine*, have been described as the active principles.

It has a considerable reputation in the treatment of dysentery and diarrhœa. A fluid extract, 1 in 1 of the bark (*dose*, 2 to 4 drachms), may be used.

Alstonia scholaris, Linn. (*Echites scholaris*, R. Brown).—A large tree, indigenous to the East Indies, Philippines, Africa, and Australia—(*not official*).

The bark (Dita Bark) is employed in medicine; it is spongy, rough on the surface and covered with whitish spots, very bitter and without smell. The active principles are three alkaloids—*Ditamine*, amorphous; *Echitamine*, crystalline; and *Echitenine*, amorphous. *Ditaine*, an amorphous substance, *various resins*, *caoutchouc*, and other bodies, are also present.

Therapeutics.—It has been much used in chronic diarrhœas and dysentery, as a tonic, and as a febrifuge in malaria. The bark in 3 to 5 grain doses, the tincture (1 in 10 proof spirit), $\frac{1}{2}$ to 2 drachms, or the infusion (1 in 10), 1 to 2 ounces, may be given.

Aspidosperma Quebracho—Quebracho—White Quebracho—(*not official*).—*Habitat*, South America.

The bark is the part used. It contains tannin and six alkaloids—*Aspidospermine*, *Aspidospermatine*, *Aspidosamine*, *Quebrachine*, *Quebrachamine*, and *Hypoquebrachine*, commercial aspidospermine being a mixture of these.

Therapeutics.—The alkaloids act much in the same way as strychnine, and the preparations are used as respiratory stimulants in bronchitis, emphysema, and asthma. In Chili it is used as an antiperiodic. A tincture (1 in 5 proof spirit) or a fluid extract (1 in 1) may be given in $\frac{1}{2}$ to 1 drachm doses.

Nat. Ord. **ASCLEPIADACEÆ**—The Milkweed Order.—Shrubs or herbs. They contain a bitter, acrid milky juice, and many are emetic, purgative, and diaphoretic. Chiefly natives of the tropics.

Official Plant.

Botanical Name.	Part Used.	Habitat.
Hemidesmus indicus.	Dried root.	India.

Hemidesmus indicus — Hemidesmus —Indian Sarsaparilla—Nunnari.

Hemidesmi Radix—*Hemidesmus Root.*—The dried root of *Hemidesmus indicus*, R. Br. (*Periploca indica*, Willd.; *P. emetica*, Retz.; *Asclepias Pseudo-Sarsa*, Roxb.).

Characters.—In cylindrical, more or less twisted, longitudinally furrowed pieces, 6 inches or more in length; covered by a thin yellowish-brown or brown corky bark, which is easily separated from the inner portion of the bark, the latter being frequently cracked in an annular manner. Odour fragrant, resembling that of melilot or Tonquin bean; taste sweetish, and very slightly acrid.

Active Principles.—No complete analysis has been made, but it contains *tannin*, *starch*, and a *stearoptene*.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Syrupus.	Bruised root.	1 oz. to $10\frac{1}{2}$ oz.	1 fluid dr.

SYRUPUS HEMIDESMI—SYRUP OF HEMIDESMUS.—*Take of hemidesmus root, bruised,* 4 *ounces; refined sugar,* 28 *ounces; boiling distilled water,* 1 *pint. Infuse the hemidesmus in the water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the sugar, and dissolve by help of a gentle heat. The product should weigh* 2 *pounds* 10 *ounces, and should have the specific gravity* 1·335.

Therapeutics.—Hemidesmus is esteemed in India as an alterative, diaphoretic, and tonic, and is employed as a substitute for sarsaparilla; but in this country it is used chiefly as a flavouring adjunct.

Adulteration or Substitution.—Inferior quality and old root are often seen. Parts of the stem are found attached, and should be rejected.

Tylophora asthmatica, Wight and Arnott—Country or Indian Ipecacuanha—(*not official*).—A twining perennial plant indigenous to the Indian Peninsula. Both the root and leaves have long been used in India as a substitute for ipecacuanha in dysentery. It is also emetic. Dose of the powder, 20 to 30 grains.

Gonolobus Condurango—Condurango—(*not official*).—Indigenous to South America. Official in the P.G. The bark is the part used; it is in quills, about 4 inches long and $\frac{1}{12}$ to $\frac{1}{4}$ inch thick, brownish in colour. No odour, but a bitter, acrid taste. It contains *gum, resin, starch, sugar, and a bitter principle.* It has been recommended as a remedy for cancer, but has proved worthless. It is, however, an excellent bitter tonic. Of the bark, 15 to 30 grains is the dose.

Solenostemma Argel, Hayne—Argel—(*not official*).—The leaves are used as an adulterant of Senna leaves, and have already been noticed under Senna.

Calotropis procera, R. Brown—Mudar—Madar (*not official*).—*Habitat*, Africa and Asia.—The dried root-bark is used, and occurs in twisted pieces $\frac{1}{8}$ inch thick, with no odour, but a disagreeable acrid taste. It contains *mucilage, resin, starch, and a bitter principle* which has not been isolated. Its properties are tonic, diaphoretic, and in the same doses as ipecacuanha (for which it has been used as a substitute) emetic. It has been prescribed in diarrhœa, dysentery, syphilitic, and other skin diseases. *Dose* in powder, 2 to 10 grains, or as an emetic, 40 to 60 grains.

Nat. Ord. **LOGANIACEÆ**—The Strychnos Order.—Shrubs, herbs, or trees, chiefly inhabiting tropical regions. The plants mostly possess highly poisonous properties.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
Strychnos Nux-vomica.	Seeds.	East Indies.
Gelsemium nitidum.	Dried rhizome and rootlets.	Southern United States.

Strychnos Nux-vomica—Nux Vomica—Poison-nut—Kuchila.

Nux Vomica—*Nux Vomica.*—The seeds of *Strychnos Nux-vomica*, Linn. (*S. Colubrina*, Wight ; *S. ligustrina*, Blume ?).

The Nux Vomica tree is moderate sized, with a short thick trunk. The fruit is a smooth globular berry about the size of an apple, with a tough rind, orange-yellow in colour, filled, when ripe, with a soft gelatinous pulp, in which the seeds are imbedded.

Characters.—Rounded in outline from about $\frac{3}{4}$ths to more than an inch in diameter, and on an average nearly a quarter of an inch thick ; flattish or concavo-convex, or sometimes more or less bent or irregular in form, rounded or somewhat acute at the margin ; marked on one surface by a central scar or hilum, from which a more or less projecting line passes to the margin, where it terminates in a slight prominence. Externally ash-grey or yellowish-grey, green and glistening from being covered with short satiny hairs, internally horny and somewhat translucent, no odour, but an extremely bitter taste.

Active Principles.—The official alkaloid, *Strychnine* ($\frac{1}{4}$ to $\frac{1}{2}$ per cent.), is the most important (see below) ; *Brucine*, $C_{23}H_{26}N_2O_4 . 4H_2O$ ($\frac{1}{2}$ to 1 per cent.), is also present ; and a third alkaloid, *Igasurine*, has been described, but is probably impure brucine. *Loganin*, $C_{25}H_{34}O_{14}$, splitting up into sugar and loganetin ; *proteids, fat, gum*, &c., are also found in the seed. The alkaloids are combined with *Strychnic* (*Igasuric*) *Acid*. Brucine is soluble in alcohol and chloroform, not in pure ether, very slightly in water ; nitric acid gives with it in powder a bright orange colour, which becomes violet on adding protochloride of tin.

Dose.—$\frac{1}{2}$ to 5 grains.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Seeds.	15 per cent. alkaloids.	$\frac{1}{4}$ to 1 grain.
Strychnina.	Seeds.	... ...	$\frac{1}{60}$ to $\frac{1}{12}$ grain.
Tinctura.	Extractum.	1 grain alkaloids in a fluid ounce.	5 to 20 minim.

EXTRACTUM NUCIS VOMICÆ—Extract of Nux Vomica.—*Take of nux vomica*, 1 *pound ; rectified spirit*, 4 *fluid ounces ; distilled water*, 16 *fluid ounces. Heat the previously-split seeds to a temperature of* 212° *F.* (100° *C.*) *for* 3 *hours*,[1] *and then reduce to a fine powder. Mix the spirit with the water, and make the powder into a paste with* 1 *pint of the mixture. Allow this to macerate for* 12 *hours, then transfer to a percolator, and add another pint of the mixture. When this has percolated, pour on the remainder of the diluted spirit in successive portions ; press the marc, filter the expressed liquor, and add it to the percolated liquid.*

The product is now tested for total alkaloids, and standardised as follows :—Evaporate by water-bath 1 *fluid ounce almost to dryness, and shake up with* 2 *fluid drachms chloroform and* $\frac{1}{2}$ *fluid ounce each dilute sulphuric acid*[2] *and water. Shake and warm gently, and separate the chloroform. To the remaining acid fluid add excess of liquor ammoniæ and* $\frac{1}{2}$ *fluid ounce chloroform, and shake well to take up the pure alkaloids. Separate the chloroform and evaporate it on a water-bath and dry for one hour at* 212° *F.* (100° *C.*) *and weigh. From the result calculate out the amount of percolated fluid which will contain* 131$\frac{1}{4}$ *grains of total alkaloids, and from it distil off the spirit and evaporate on a water-bath till it weighs* 2 *ounces, when it will contain* 15 *per cent. of total alkaloids.*

Test.—Ten grains of the extract, when treated in the following manner, should yield $1\frac{1}{2}$ grains of total alkaloids. Dissolve the extract in $\frac{1}{2}$ fluid ounce of water, heating gently if necessary, and add 1 drachm sodium carbonate,[3] dissolved in $\frac{1}{2}$ fluid ounce of water and $\frac{1}{2}$ fluid ounce of chloroform; agitate, warm gently, and separate the chloroform. Add to this $\frac{1}{2}$ fluid ounce of dilute sulphuric acid[4] with an equal bulk of water; again agitate, warm and separate the acid liquor from the chloroform. To this acid liquor add now an excess of liquor of ammonia,[5] and agitate with $\frac{1}{2}$ fluid ounce of chloroform; when the liquors have separated, transfer the chloroform to a weighed dish and evaporate the chloroform over a water-bath; dry and weigh.

[1] The seeds are difficult to powder, and this is to a great extent overcome when they are dried. [2] To form sulphates of the alkaloid which are soluble. [3] To neutralise the igasuric acid, and set free pure alkaloid dissolved by the chloroform. [4] This forms soluble sulphates. [5] To again set free pure alkaloid taken up by the chloroform.

This is a Standardised Extract, but it varies in strength by evaporation, unless kept in carefully-stoppered bottles.

Official Preparation.

Tinctura, 133 grains in 20 fluid ounces, or 1 grain total alkaloids in each fluid ounce.

Dose.—5 to 20 minims.

TINCTURA NUCIS VOMICÆ—Tincture of Nux Vomica.—*Take of extract of nux vomica,* 133 *grains; distilled water,* 4 *fluid ounces; rectified spirit to make* 20 *fluid ounces, in which dissolve the extract.*

This is a Standardised Tincture, in which 1 fluid ounce contains 1 grain of total alkaloids.

Strychnina—Strychnine.—An alkaloid ($C_{21}H_{22}N_2O_2$), obtained from Nux Vomica.—*Syn.* Strychnia.

Preparation.—*Take of nux vomica,* 1 *pound; acetate of lead,* 180 *grains; solution of ammonia, a sufficiency; rectified spirit, a sufficiency; distilled water, a sufficiency.*

After the seeds have been softened and prepared for the process by steaming and grinding, they are subjected for 12 *hours to the action of a mixture of rectified spirit and water, and are then strained and pressed. By this part of the process, which is twice repeated, the igasurates of* *strychnine and brucine are separated, together with some extractive and colouring matter. When the spirit has been distilled off from the mixed fluid, and the watery residue has been sufficiently evaporated and filtered, a solution of acetate of lead is added, whereupon a double decomposition ensues, igasurate of lead being precipitated, whilst acetates of strychnine and brucine remain in solution. The precipitate is removed by filtration. After evaporation, solution of ammonia is added to the clear fluid, whereupon acetate of ammonium is formed in solution, whilst the alkaloids, strychnine and brucine, are gradually precipitated during the subsequent* 12 *hours. This precipitate is now washed with distilled water, dried and boiled with rectified spirit; and when the liquor is subsequently evaporated to the bulk of half an ounce and cooled, the strychnine, being less soluble than the brucine, crystallises out, forming a crust upon the vessel, whilst the brucine is poured off in the mother liquor. Finally, any adherent brucine is removed by washing with a mixture of rectified spirit and water, its entire absence being denoted by the nitric acid test; and the strychnine is recrystallised from its solution in boiling rectified spirit.* For full details, see B.P.

Characters.—In right square octahedrons or prisms, colourless and inodorous; sparingly soluble in water, but communicating to it an intensely bitter taste; soluble in boiling rectified spirit and in chloroform, but not in absolute alcohol or in ether. Pure sulphuric acid forms with it a colourless solution, which, on the addition of bichromate of potash, acquires an intensely violet hue, speedily passing through red to yellow.[1] Not coloured by nitric[1] or sulphuric acid;[2] leaves no ash when burned with free access of air.[3] A very active poison.

[1] These distinguish it from Brucine. [2] Absence of organic matters and several other alkaloids. [3] Absence of inorganic matters.

Strychnine is also met with in the form of a granular powder. Cold water dissolves only about one seven-thousandth part of strychnine, but nevertheless is rendered distinctly bitter by it. It is soluble in about 2500 parts of boiling water, in 110 of alcohol, in 6 of chloroform. Strychnine is insoluble in the caustic alkalies, but is soluble in the essential oils. It is fusible, but not volatile, and decomposes at a low temperature. In addition to its physiological properties, strychnine may be recognised by the following chemical tests:—Terchloride of gold gives a reddish-yellow precipitate,[1] bichloride of platinum a yellow granular precipitate,[1] and infusion of galls a white precipitate.[2] When dissolved in hydrochloric acid, corrosive sublimate gives a white clotty precipitate.[1] Pure sulphuric acid forms a colourless solution. With perfectly pure strychnine nitric acid does not give a red colour, but with the strychnine of commerce it usually does so, in consequence of the presence of brucine and yellow colouring matter. The sulphuric acid and bichromate test is said to be sensitive to nearly one in a millionth part. The sulphate, nitrate, and hydrochlorate of strychnine are soluble in water, and more readily so in the presence of free acid. An alcoholic solution turns a ray of light to the left.

[1] Double salts, showing that it is an alkaloid. [2] Tannate of strychnine. In strychnine poisoning, the vomited matters may be treated with strong sulphuric acid, which dissolves the poison, but chars all organic matters, and these latter can be removed by filtration, leaving the strychnine in solution.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Liquor Hydrochloratis.	Alkaloid.	1 in 100 (about).	5 to 10 minims.

LIQUOR STRYCHNINÆ HYDROCHLORATIS—SOLUTION OF STRYCHNINE—*Syn.* Liquor Strychniæ.—*Take of strychnine, in crystals,* 9 *grains; diluted hydrochloric acid,* 14 *minims; rectified spirit,* 4 *fluid drachms; distilled water,* 12 *fluid drachms. Mix the hydrochloric acid with* 4 *drachms of the water, and dissolve the strychnine in the mixture by the aid of heat; then add the spirit and the remainder of the water*

If excess of acid be used, the strychnine is thrown out.

SYRUPUS FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM—SYRUP OF THE PHOSPHATES OF IRON, QUININE, AND STRYCHNINE, B.P.C.—(*not official*).—*Take of strychnine, in powder,* 5 *grains; concentrated phosphoric acid, specific gravity* 1·5, 75 *minims; distilled water,* 225 *minims. Dissolve and add phosphate of quinine,* 120 *grains. Dissolve by the aid of a gentle heat, and add syrup of phosphate of iron, sufficient to produce* 1 *pint. Mix thoroughly. Each fluid drachm contains* 1 *grain phosphate of iron,* $\frac{3}{4}$ *grain phosphate of quinine, and* $\frac{1}{32}$ *grain strychnine.*

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

The above is a modification of the syrup introduced by the late Prof. Easton of Glasgow.

SYRUPUS FERRI, QUININÆ ET STRYCHNINÆ HYDROBROMATUM—SYRUP OF THE HYDROBROMATES OF IRON, QUININE, AND STRYCHNINE, B.P.C.—(*not official*).—*Syn.* Syrupus Ferri Bromidi cum Quinina et Strychnina.—*Take of strychnine, in powder,* $2\frac{1}{2}$ *grains; acid hydrobromate of quinine,* 160 *grains; diluted hydrobromic acid,* 1 *fluid ounce; distilled water,* 1 *fluid ounce. Mix the diluted hydrobromic acid with the distilled water, and in the mixture dissolve the strychnine and acid hydrobromate of quinine by the aid of a gentle heat. Then add syrup of bromide of iron sufficient to produce* 1 *pint. Each fluid drachm contains* $\frac{1}{64}$ *grain strychnine,* 1 *grain acid hydrobromate of quinine, and about* 4 *grains bromide of iron.*

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

The bark (*not official*) of *Strychnos nux vomica* also contains *strychnine and brucine*, but in small proportions. It has been called False Angustura Bark or Rohun, the former from the fact of its supposed resemblance to Angustura or Cusparia Bark, but it may be distinguished as follows :—Nux vomica trunk bark is irregular in shape, thick and hard ; grey externally and brown internally ; no odour, and a purely bitter taste, and the fractured surface has no white spots of calcium oxalate. When touched with strong nitric acid, the inner fresh cut surface becomes blood-red (Brucine).

Therapeutics.—Nux vomica and its preparations, when given in small medicinal doses, repeated at regular intervals, act as tonics by a local action on the gastric mucous membrane, as well as by a constitutional action on the nervous system, the digestive powers and appetite are increased and the action of the bowels is stimulated. They also exercise a special stimulant effect upon the medulla oblongata and spinal cord, the brain being comparatively little affected, although sight and hearing become sharper. The circulation and respiration are stimulated in consequence of the action on the nerve centres. In larger doses, they act more distinctly upon the spinal cord, and also somewhat as gastric irritants; the stomach is disordered, the spirits are depressed, the patient becomes exceedingly sensitive to external impressions, complains of weariness, and a sense of creeping in his limbs, which sometimes tremble and sometimes feel stiff; he has some difficulty in maintaining the upright position, and not unfrequently staggers in his gait. Convulsive spasms of the muscles from the most trivial impressions ensue if the drug be continued, and most of the muscles are implicated. At the same time, if any part of the body be paralysed, twitchings, which increase in frequency and power, may be observed in the affected muscles. In still larger doses, these symptoms are intensified and regular tetanic convulsions occur, until death occurs from asphyxia. A case has been recorded in which death ensued in fifteen minutes after taking the poison ; but more commonly the fatal result occurs between one and ten or twelve hours afterwards. Much depends upon the habits of the patient with respect to the drug, and the condition of the stomach with respect to food, as to the effects produced, and the period of their manifestation.

Strychnine and its salts act for the most part like nux vomica. When taken in poisonous doses, the symptoms which ensue are more or less as follows :—If taken in solution, it has an intensely bitter taste. After a certain interval, often without any warning, the victim suddenly feels a sense of suffocation, and the muscles of the head and limbs, if not of the entire body, are affected with tremblings and twitchings. In a little while longer tetanic convulsions seize almost the entire frame, and the body becomes rigidly fixed, with the head bent backwards, the body also arched backwards (opisthotonos), the hands clenched, the soles of the feet incurved, the face congested, and the expression of the countenance, caused by the spasmodic contraction of the muscles, that of the *sardonic grin.* There is heat and dryness of the fauces, and sometimes frothing at the mouth, with fixity of the jaws, and an anxious feeling of impending suffocation. The intellect is generally but little, or not at all, affected during the intermissions; on the contrary, the external senses are usually exceedingly acute. The fits last from half-a-minute to two or more minutes, recur at shorter and shorter intervals, and are longer continued towards the end. In the intervals the person feels exhausted, and terribly anxious; he generally knows when a paroxysm is coming on, and cries out either to be held, or that he will die. Very slight causes, such as the closing of a door, the rattling of articles upon the table, or a light touch, may produce a paroxysm. Death either takes place by asphyxia during a paroxysm, or by exhaustion in the interval. These symptoms somewhat resemble those of tetanus, but the history, mode of onset, and rapid development are generally sufficient to distinguish them. In strychnic poisoning the muscles of the jaw are last affected, and after a convulsion there is complete relaxation. In tetanus the reverse is the rule. One-sixteenth of a grain of strychnine has killed a child between two and three years of age, in four hours; and an adult has died in fourteen minutes, from the effects of half-a-grain of sulphate of strychnine. Half-a-grain of strychnine would be a dangerous dose for an adult, although some persons have recovered after taking three or more grains, and doses have frequently been increased to a grain without producing marked results. The period at which the symptoms supervene varies, but the effects of a poisonous dose are usually observed within from five to twenty minutes after taking it, and in fatal cases, death generally occurs within two hours. Strychnine is thus a powerful convulsant poison, and the convulsions are spinal, due to its stimulant action on the motor cells of the spinal cord. It paralyses the motor efferent nerves and increases arterial pressure. Its action on the digestive canal is chiefly local. It was formerly thought that the addition of the radicals methyl or ethyl to strychnine completely altered its tetanising action and changed it into a paralysing one; but it is now known that these addition-products stimulate the spinal cord as strychnine does, although more feebly, and that they are only more paralysing to motor nerves, thus masking the convulsions.

Strychnine is employed in the cases already mentioned under nux vomica, but is more commonly used in paralysis. Unless it be employed judiciously, strychnine may produce evil rather than good effects, for it is not in all cases of paralysis that its exhibition is indicated. It should not be given in cases in which the paralysis is due to an inflammatory condition of the brain or spinal cord, nor in those in which it is the consequence of the pressure of effused blood; and in those cases in which the paralysis is due to organic lesion of the nervous centres, it often does harm rather than good. It is not until inflammatory symptoms in the one case, and the effused blood in the other, have been removed, that strychnine produces its good effects in the removal of the paralysis, which is still apt to remain. It is most beneficial in the paralysis of certain organs, as of the bladder, the sphincter ani, and other parts, and in such cases it is sometimes better to apply it near the part hypodermically, than to give it internally. It has been sometimes found useful in the treatment of local palsy, the result of lead or mercurial poisoning, or of rheumatism, or diphtheria, and in those cases also its local action is often to be preferred. It is useless, however, if the paralysis has existed so long that the muscles have undergone fatty degeneration, so that they no longer respond to a slowly interrupted galvanic current. In amaurosis it is sometimes of advantage, and in tobacco amblyopia it does great good. In muscular tremors, nervous exhaustion, impotence, and other cases mentioned under nux vomica, strychnine may be cautiously tried.

The Dose of Strychnine.—$\frac{1}{30}$ cautiously increased to $\frac{1}{12}$ of a grain, given in pill with bread crumb or confection of roses, the alkaloid being first dissolved in a drop of rectified spirit or weak acid, so as to ensure its equal distribution throughout the pill mass. For hypodermic use its dose is $\frac{1}{50}$ grain gradually increased, and it should be injected into the substance of the paralysed muscle. The dose of its salts is the same, and for hypodermic use the sulphate may be preferred to strychnine, as it is more soluble.

Treatment of an over-dose.—Emetic or stomach-tube. There is no satisfactory chemical antidote, although tannic acid or iodine form compounds which are not permanent, but may delay its absorption until an emetic be given.

Chloral hydrate should be given in large doses, 30 to 40 grains, either alone or with potassium bromide, and repeated in a dose graduated to the effects produced. Chloroform or ether inhalation, and if necessary artificial respiration, to diminish the severity of the convulsions and save the patient's strength and ward off asphyxia, is probably the most efficient treatment. The action of brucine is similar to that of strychnine, but it is only about one quarter as active.

Adulterations and Substitutes.—The seeds are too characteristic to be adulterated. The powder is said to sometimes contain salt or other substances which have been added to facilitate powdering. Its bitterness distinguishes it from many other powders.

Strychnos Ignatii, Bergius—Strychnos amara.

SEMEN IGNATIÆ—FABA IGNATIÆ—*Ignatia*—*Bean of St Ignatius.* —*Habitat*, The Philippine Islands—(*not official*). Official in the U.S.P.

Characters.—One to $1\frac{1}{4}$ inch long, $\frac{1}{2}$ to $\frac{4}{5}$ inch broad, oblong-ovate, or roundish-ovate in shape, but by pressure on one another often angular and irregular. The hilum is in a small depression. The surface of the seed is of a dull reddish-grey or brown covered with silky grey or silky brownish hairs. Like nux vomica, the albumen is horny and of the shape of the seeds, translucent at the edges, surrounding an irregular cavity into which the embryo projects, and consists of a rather long radicle and oblong-ovate cotyledons. The seeds break with an irregular granular fracture, and like nux vomica soften under prolonged digestion. They have little or no odour, but an extremely bitter taste.

Active Principles.—*Strychnine* (about $\frac{1}{2}$ to $1\frac{1}{2}$ per cent.) and *Brucine.*

Therapeutics.—Same as nux vomica. A tincture (1 in 10) made with dilute alcohol may be given in 5 to 20 minim doses.

Strychnos Tieute, Lesch.—The seeds yield strychnine and brucine, and are the chief ingredients of the arrow-poison *Upas-tieute.* It is indigenous to Java. *S. Gauthieriana* bark, known in China as *hoàng-nàn,* also contains the two alkaloids. *S. Akazga* seeds yield an alkaloid, *Akazgine,* which in many ways resembles *Strychnine.*

Curare — Urari — Wourari — Wourali — Woorara. — The South American Indian Arrow-Poison—(*not official*).

It is a dark-brown solid extract, inodorous, bitter in taste, and about 60 or 70 per cent. of which is soluble in water. Water dissolves out an alkaloid, *Curarine,* which is the chief active principle, a second alkaloid, *Curine,* being also present. Curarine ($C_{18}H_{35}N$?) is very bitter, gives a deep red colour with nitric acid, and a violet with sulphuric acid and potassium bichromate.

Curare is a watery extract of *Strychnos toxifera, S. Castelneæ, S. triplinervia,* and other South American species.

INJECTIO CURARE HYPODERMICA—HYPODERMIC INJECTION OF CURARE, B.P.C.—(*not official*).—*Take of curare,* 5 *grains; distilled water, a sufficiency. Powder the curare and add water to form a thin paste* (*avoiding handling it*), *pour on a filter having in it a plug of cotton wool. Filter till* 1 *fluid drachm is collected. If required in haste, the curare may be powdered, thrown on a filter, and distilled water poured on till* 1 *fluid drachm is collected.*

Dose.—1 to 6 minims.

Therapeutics.—Curare in small doses paralyses the terminations of motor nerves ; it, however, in addition, stimulates the spinal cord in the same way as strychnine does, but this action is masked, as no twitchings or convulsions can be manifested owing to the motor paralysis. It has been used as an antidote to strychnine poisoning, and in chorea, epilepsy, rabies, and tetanus ; but these uses are all based on an imperfect recognition of its real action on the central nervous system, and have not been justified by success in practice. Curine has an action on the heart resembling digitalis.

Spigelia marilandica, Linn.—Indian Pink—Carolina Pink—(*not official*).—*Habitat,* United States.

Botany.—Perennial. *Root-stock,* small, knotty, twisted, giving off long, slender, matted yellow roots. *Stem,* quadrangular, erect, purplish, smooth, ½ to 2 feet high. *Leaves,* ovate-lanceolate, acute, spreading 2 or more inches long, few in number, sessile, smooth, paler beneath. *Flowers,* forming a terminal scorpioid spike without bracts, sessile or short stalks, and bright pink in colour. *Fruit,* made up of two round lobes, with a thin pericarp dehiscing loculicidally; smooth yellowish or brownish. *Flowering time*, June or July.

The rhizome is the part generally used in medicine. It contains a little *volatile oil*, *resin*, *tannin*, a *bitter principle*, and an alkaloid *Spigeline*, but the active substance is not definitely known.

Therapeutics.—It is used, in 15 to 60 grain doses of the powder or drachm doses of the fluid extract (U.S.P.), as a remedy against intestinal worms, more especially the *Ascaris lumbricoides*. It has some purgative action, and if absorbed may cause a good deal of giddiness and cerebral disturbance. Hence it is generally given along with senna and aromatics to ensure its prompt evacuation from the bowel.

Gelsemium nitidum—Yellow Jasmine—False Jasmine—Wild Yellow Jessamine.

GELSEMIUM—*Gelsemium—Yellow Jasmine.*—The dried rhizome and rootlets of *Gelsemium nitidum*, Michaux (*G. sempervirens*, Aiton; *G. lucidum*, Poir; *Bignonia sempervirens*, Linn.).

Characters.—The rhizome is nearly cylindrical, from $\frac{1}{2}$ an inch to 6 inches or more in length, $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter, with small rootlets attached to or mixed with the larger pieces; light yellowish-brown externally, and marked longitudinally by dark purple lines; fracture splintery; bark thin, with silky fibres in its liber closely attached to a pale yellow porous woody axis, with evident medullary rays, and with or without pith. Odour somewhat narcotic and aromatic, taste bitter.

Active Principles.—There are two alkaloids, *Gelsemin* and *Gelseminin*, combined with *Gelsemic acid*, *volatile oil*, *resin*, *starch*, &c.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum alcoholicum.	No. 60 powder.	... ...	$\frac{1}{2}$ to 2 grains.
Tinctura.	No. 40 ,,	1 in 8.	5 to 20 minims.

EXTRACTUM GELSEMII ALCOHOLICUM — ALCOHOLIC EXTRACT OF GELSEMIUM.—*Take of gelsemium, in No.* 60 *powder*, 1 *pound; rectified spirit*, 40 *ounces. Prepared by maceration and percolation; water being added to the percolator to displace the whole* *of the spirit; and finally the tincture is evaporated to pilular consistence.*

TINCTURA GELSEMII—Tincture of Gelsemium.—*Take of gelsemium, in No.* 40 *powder,* 2½ *ounces; proof spirit,* 20 *ounces. Prepared by maceration and percolation.*

Tincture of Gelsemium has a well-marked fluorescence due to the presence of *Gelsemic Acid.*

GELSEMIN—Gelsemin—(*not official*).—Is an extract in the form of powder, prepared by alcohol.

Dose.—½ to 2 grains.

Therapeutics.—Gelsemin has an action like strychnine, but very much weaker; gelseminin acts very similarly to conine, and is the constituent which chiefly determines the effects of gelsemium preparations. Poisoning has frequently occurred with these, the most prominent symptoms being depression of the spinal cord and medulla, loss of power of voluntary movement, numbness and staggering, with death from paralysis of the respiratory centre; the pupil is dilated. Locally applied, gelseminin dilates the pupil, and paralyses accommodation; it does so also when taken internally, but much more slowly.

Gelsemium is given as an antispasmodic in exaggerated nervous irritability, as neuralgias of all kinds, in chorea, whooping-cough, asthma, and laryngismus stridulus. It has also been used in rheumatism, lumbago, and myalgias, in dysmenorrhœa, and many other conditions, but opinion as to its real value is very much at variance.

Nat. Ord. **GENTIANACEÆ**—The Gentian Order.—Herbs, rarely shrubs, universally distributed. The plants are usually bitter; some have emetic and narcotic properties.

Official Plants.

Botanical Name.	Part Used.	Habitat.
Gentiana lutea.	Dried root.	Mountains of Central and Southern Europe.
Ophelia Chirata.	Entire plant.	Northern India.

Gentiana lutea—The Gentian Plant—Yellow Gentian—Great Gentian.

GENTIANÆ RADIX—*Gentian Root.*—The dried root of *Gentiana lutea.* Collected in the mountainous districts of Central and Southern Europe.

Characters.—In more or less cylindrical pieces or longitudinal slices, from a few inches to a foot or more in length, and from $\frac{1}{2}$ to 1 inch thick; wrinkled in an annular manner when the pieces have been derived from the upper part of the root, and all marked with irregular longitudinal furrows; deep yellowish-brown externally, yellowish or reddish-yellow within; tough and brittle when dry. Bark thick, reddish, and separated from the central woody portion, which is somewhat spongy, by a dark-coloured cambium zone. Odour heavy and peculiar; taste at first sweetish, but afterwards very bitter. An infusion, when cool, is not coloured blue by solution of iodine.[1]

[1] Absence of starch.

Active Principles.—The bitterness is due to *Gentiopicrin* or *Gentian Bitter* (about $\frac{1}{10}$ per cent.), a crystalline glucoside, soluble in water and spirit. *Gentisic Acid*, *pectin*, a sugar called *Gentianose*, *fixed oil*, &c., are also present. Starch and tannin are absent.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Sliced root.	...	2 to 10 grains.
Infusum Compositum.	,, ,,	1 in 80.	1 to 2 fluid ounces.
Tinctura ,,	Bruised ,,	1 in $13\frac{1}{3}$.	$\frac{1}{2}$ to 2 fluid drachms.

EXTRACTUM GENTIANÆ—EXTRACT OF GENTIAN.—*Take of gentian root, sliced,* 1 *pound; boiling distilled water,* 1 *gallon. Infuse the gentian in the water for two hours; boil for fifteen minutes; pour off, press, and strain. Then evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills.*

INFUSUM GENTIANÆ COMPOSITUM—COMPOUND INFUSION OF GENTIAN.—*Take of gentian root, sliced, bitter orange peel, cut small, of each,* 55 *grains; fresh lemon peel, cut small,* $\frac{1}{4}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

TINCTURA GENTIANÆ COMPOSITA—COMPOUND TINCTURE OF GENTIAN.—*Take of gentian root, cut small and bruised,* $1\frac{1}{2}$ *ounce;*

bitter orange peel, cut small and bruised, $\frac{3}{4}$ *ounce; cardamom seeds, freed from the pericarps and bruised,* $\frac{1}{4}$ *ounce; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

Therapeutics.—Gentian acts as a purely bitter tonic. It is useful, along with alkalies or acids, in atonic dyspepsia with acidity, and in a variety of cases associated with nervous debility and inactivity of the digestive system, as in convalescence from acute diseases, fevers, &c., in dyspepsia, from abuse of tea, from sedentary habits, mental or bodily exhaustion, &c. It is also somewhat anthelmintic, and in over-doses may act as a nauseant and laxative.

Incompatibles.—Salts of the heavy metals.

Adulterations or Substitutions.—Gentian root is not often systematically or wilfully adulterated, but roots growing in the same districts are apt to be mistaken for it, and chief amongst them are *G. purpurea*, Linn., which is yellowish externally and dark-brown inside; *G. pannonica*, Scopoli, is not so much ringed as the official gentian, and is yellowish-brown externally and whitish within; *G. punctata*, Linn., is so like official gentian as to be frequently substituted for it, but it is yellowish-brown in its substance. These all possess similar properties to yellow gentian, and their substitution would cause no inconvenience. The roots of Aconite, Belladonna, White Hellebore, and Orris have been found as adulterants. The last is easily detected by its fragrant odour, absence of bitterness, and lighter colour. The other three are serious adulterants on account of their poisonous nature. They all lack the bitterness of gentian and the yellow internal colour; aconite produces the characteristic tingling feeling on the tongue; belladonna has not much taste; and white hellebore is bitter, but not so much so as gentian, and it is highly acrid and nauseous.

Ophelia Chirata.—The Chiretta Plant.

CHIRATA—*Chiretta.*—The entire plant, *Ophelia Chirata*, Griseb.—Collected when the fruit begins to form, and dried.

Characters.—Root, 2 to 3 inches long, usually unbranched. Stem, 3 feet or more long, rounded below,[1] quadrangular above, branched dichotomously, smooth, orange-brown or purplish. Leaves ovate, 5- to 7-ribbed. Flowers small, numerous panicled. No odour. Taste very bitter. Stem, except below, consists of a thin woody ring enclosing a large yellowish pith.[2] It is put up in small bundles.

[1] The stem of *O. angustifolia* is quadrangular throughout and winged. The stem of *Andrographis paniculata* is likewise quadrangular throughout. [2] *O. angustifolia* has little or no pith.

Active Principles. — *Ophelic acid*, $C_{13}H_{20}O_{10}$, a bitter amorphous body, and *Chiratin*, $C_{26}H_{48}O_{15}$, bitter and crystalline, decomposing, when boiled with dilute mineral acids, into ophelic acid and chiratogenin, are the active substances; *tannin* in very small amount, and the ordinary constituents of plants are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Herb cut small.	1 in 40.	1 to 2 fluid ounces.
Tinctura.	,, ,, and bruised.	1 in 8.	½ to 2 fluid drachms.

INFUSUM CHIRATÆ — Infusion of Chiretta. — *Take of chiretta, cut small, ¼ ounce; distilled water at 120° F. (48°·9 C.), 10 fluid ounces. Infuse in a covered vessel for half-an-hour, and strain.*

Water at 120° F. is used in order to remove none, or as little as possible, of the tannin and albuminous matters; thus this preparation is compatible with iron salts.

TINCTURA CHIRATÆ — Tincture of Chiretta. — *Take of chiretta, cut small and bruised, 2½ ounces; proof spirit, 1 pint. Prepared by maceration and percolation.*

Therapeutics.—Chiretta acts as a bitter non-astringent tonic and stomachic. It is used in the same cases as gentian, to which it is closely allied in its medicinal properties.

Adulterations or Substitutions.—Lobelia is not unlike chiretta, but the former has not a bitter taste. In India many plants are known by the name of Chiretta, and it is important to know the characters of the most likely adulterants. *O. angustifolia*, Don, Hill or Puharee Chiretta, is not so bitter, has quadrangular stems throughout, and winged somewhat. It has a thick woody ring outside and a central hollow, or only traces of a pith. *Rubi cordifolia*, Munjista or Munjeet, has been found as a substitute. It has no pith, and its leaves are petiolate. *Andrographis paniculata*, Nees, Kariyát, has quadrangular winged stems, light-brown, and furrowed longitudinally; lanceolate leaves; rose-pink flowers. It belongs to the natural order *Acanthaceæ.* Other plants of the genus *Ophelia*, such as *elegans*, *densifolia*, *multiflora*, &c., are also known as Chiretta, and possess the same bitter properties, and are possibly quite as good as the official drug.

Menyanthes trifoliata, Linn.—Buckbean, Bogbean, Water Trefoil, Water Shamrock—(*not official*).—*Habitat*, temperate regions of Old and New World.

Botany.—Perennial. Rhizomes, long, creeping, or prostrate, about ½ inch in diameter, succulent, with remains of leaf scars. *Leaves*, alternate on long petioles, forming at the base thick membranous sheaths, surrounding the stem at the insertion. *Leaflets*, trifoliate, sessile, oblong-oval or oblong-obovate, entire or nearly so, green, glaucous. *Flowers*, few, on glabrous pedicles, forming erect blunt racemes; bracts ovate, membranous, obtuse. *Fruit*, an ovoid capsule, nearly ½ an inch long, smooth, pale-brown, with a thin pericarp; dehisces loculicidally. *Flowering time*, June or July.

Therapeutics.—The leaves or whole plant are used, now almost entirely in domestic medicine. It is a bitter, due to the presence of *Menyanthin*, a glucoside, and in small doses is a gastric tonic, in large doses cathartic and emetic. It is used in "herb beer." The expressed juice from fresh plants, or the infusion from dried leaves or herbs, may be given in 1 to 2 ounce doses.

Nat. Ord. **BORAGINACEÆ**—The Borage Order.—Herbs or shrubs, with round rough stems and alternate leaves; temperate regions in the northern hemisphere. Plants chiefly mucilaginous, and some contain colouring agents (*not official*).

Borago officinalis, Linn.—Borage—(*not official*).

Botany.—An erect *annual. Stem*, branching 1 to 2 feet high. *Leaves*, alternate oval or obovate, the lower ones being petiolate, entire, or having wavy margins, hairy on both sides, but most on the upper. *Flowers*, in terminal racemes, with ovate bracts and bluish or reddish-blue in colour. *Fruit*, four brown ovate nuts. The whole plant has a saline taste, and a smell not unlike cucumber. *Flowering time*, June and July. *Habitat*, waste ground, but can hardly be called a native.

The active principles are mucilage, albuminous matter, and salts; but no one seems to have any special action. It is regarded as demulcent, diuretic, and diaphoretic. It is drunk in hot infusion (about 2 to 4 drachms of the whole plant), and probably any action it has is due to the hot liquid.

Alkanna (Anchusa) **tinctoria**, Tausch—Alkanet—(*not official*).—A perennial herb, cultivated in Western Asia and South-Eastern Europe. ALKANNÆ RADIX—*Alkanet Root*—(*not official*). *Characters.*—About 4 inches long and about the thickness of the finger, having here and there the remains of the whitish hairy leaves. The bark is soft, thin, separable into layers, and has a dark purple-red colour. It covers a hard, irregularly twisted yellow-coloured woody part. It has no odour, or only a very faint one, and is nearly tasteless. It does not tinge water. From the bark can be obtained a dark purplish-brown resin-like mass, *Alkannin* or *Anchusin*, insoluble water, soluble ether, alcohol, fats, and some volatile oils, with a red colour; in alkalies, blue. An alcoholic solution of alkanet root treated with solution of ammonia is turned green. Used to colour tinctures, oils, and pomades.

Symphytum officinale, Linn.—Comfrey—Knit-bone—(*not official*).—An infusion of the root, or the root stirred in melted lard and strained, is used in many parts of England as a dressing for sprains, broken bones, &c.; hence one of its names, Knit-bone, from its supposed property of being able to knit bones together. The chief constituents of the root are *starch* and *mucilage*. The young leaves are sometimes used as a vegetable.

Nat. Ord. **CONVOLVULACEÆ**—The Convolvulus Order.—Herbs or shrubs, usually twining, frequently milky, chiefly inhabiting the tropics. The plants generally possess purgative properties, due to the presence of glucosides.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
CONVOLVULUS SCAMMONIA.	Dried root and gum-resin.	Syria and Asia Minor.
IPOMŒA PURGA.	Dried tubercles.	Mexico.

Convolvulus Scammonia—The Scammony Plant.

SCAMMONIÆ RADIX—*Scammony Root.*—The dried root of *Convolvulus Scammonia*, Linn., from Syria and Asia Minor (*C. pseudo-Scammonia*, C. Koch).

Characters and Tests.—Unbranched, of varying lengths and sizes, cylindrical except towards its upper end, where it is enlarged and presents usually some remains of the slender aërial stems; more or less shrivelled, longitudinally furrowed, greyish-brown or yellowish externally, pale brown or whitish within, and when fractured small fragments of pale yellowish-brown resin may often be seen on the surface of the fracture. Odour and taste faint, somewhat resembling jalap. Rectified spirit, agitated with the powder and evaporated, leaves a residue having the properties of scammony resin.

Active Principles.—The root contains *gum*, *tannin*, *sugar*, *starch*, *and extractives*, but most important a resin, *Scammonin*, supposed to be identical with *Jalapin*, $C_{34}H_{56}O_{16}$ (see Jalap). Beyond this, little is known of its chemistry.

SCAMMONIUM—*Scammony.*—A gum-resinous exudation obtained by incision from the living root of *Convolvulus Scammonia*, Linn., hardened in the air.[1]

Characters and Tests.—As usually found in commerce it is in flattish cakes or pieces of irregular form and of varying sizes, ash-grey or blackish-brown externally and sometimes sprinkled over with a greyish-white powder. It is very brittle, and when fractured the surface is resinous, shining, more or less porous, and of a uniform dark greyish-black colour; easily triturated into an ash-grey powder, which forms with water a smooth emulsion.[2] Odour peculiar, cheesy, and when chewed causing a slight pricking sensation in the back of the throat. It does not effervesce with hydrochloric acid.[3] A cooled decoction is not rendered blue by solution of iodine.[4] Ether removes about 75 per cent. of resin, and what remains is chiefly soluble gum with a little moisture.[5]

Dose.—5 to 10 grains.

[1] In collecting scammony the earth around the root is cleared away, so as to leave a few inches of the root exposed. This is cut in an oblique direction at about the middle of the exposed part. From the cut surface a milky juice exudes and is received in a mussel-shell. The best scammony is allowed to dry in the shell, but this is not brought into commerce, being kept by the natives for their own use. The various shells are usually emptied into a covered vessel or leather bag, and dried at once. This forms good or fine scammony, and is known in commerce as Virgin Scammony. When scammony is not at once allowed to dry, but is collected in large quantities and retained in liquid state for a lengthened period, it undergoes fermentation and becomes porous and dark in colour, and is consequently inferior to the aforementioned. [2] Showing it is a gum-resin, and is thus unlike the pure resin. [3] Absence of chalk. [4] Absence of flour or starch. [5] Absence of earthy matters, black lead, &c.

Chemistry.—Scammony contains from about 75 to 95 per cent. of *resin*, along with *gum*, *colouring*, and *inorganic matter*.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Mistura.	Scammony.	3 grains in 1 fluid ounce.	1 to 3 fluid ounces.

As the B.P. directs, the Resin may also be prepared from Scammony.

MISTURA SCAMMONII—SCAMMONY MIXTURE.—*Take of scammony, 6 grains; milk, 2 fluid ounces. Triturate the scammony with a little of the milk, and continue the trituration, gradually adding the remainder of the milk until a uniform emulsion is obtained. The mixture should be made as required for use.*

Official Preparation from Root or from Scammony.

Scammoniæ Resina, . . . *Dose*, 3 to 8 grains.

SCAMMONIÆ RESINA—RESIN OF SCAMMONY.—*Take of scammony root, in coarse powder, 8 ounces; rectified spirit and distilled water, of each a sufficiency. A strong tincture is made by digesting for twenty-four hours at a moderate heat in 16 fluid ounces of the spirit, then exhausting by percolation, and adding 4 fluid ounces of water to throw out the resin, distilling off the spirit, removing to an open dish and letting cool, pouring off the supernatant fluid, washing the resin with hot water to remove impurities, and drying on a water-bath or by the heat of a stove. It may also be prepared in the same way from scammony.*[1]

Characters and Tests.—In brownish translucent pieces, brittle, resinous in fracture, of a sweet fragrant odour if prepared from the root. It cannot alone form an emulsion with water.[2] Its tincture does not render the fresh-cut surface of a potato blue.[3] Ether dissolves it entirely.[4]

Dose.—3 to 8 grains.

[1] This would be expensive. [2] Because it is a pure *resin*, not a *gum-resin* as is scammony (see Guaiacum for definition of a resin). [3] This distinguishes it from Guaiacum. [4] This distinguishes it from Jalap Resin. It is soluble in oil of turpentine, alcohol, liquid ammonia, and warm solution of potash.

Chemistry.—The yield of resin from the root is about 5 per cent. The resin consists of *colouring matter* and *Scammonin*, the latter a white, tasteless, inodorous glucoside which is said to be the anhydride of *Scammonic Acid*, and when boiled with dilute mineral acids it yields *glucose* and *scammonic Acid* (see Jalap).

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Confectio.	Resin.	1 in 3.	10 to 30 grains.
Pilula Composita.	„	1 in $3\frac{1}{4}$.	5 to 15 „
Pulvis Compositus.	„	1 in 2.	10 to 20 „

Also contained in *Extractum Colocynthidis Compositum* (1 in 6); *Pilula Colocynthidis Composita* (1 in 3); *Pilula Colocynthidis et Hyoscyami* (1 in $4\frac{1}{2}$).

CONFECTIO SCAMMONII—CONFECTION OF SCAMMONY.—*Resin of scammony, in powder*, 6 *ounces; ginger, in fine powder*, 3 *ounces; oil of caraway*, $\frac{1}{4}$ *fluid ounce; oil of cloves*, $\frac{1}{8}$ *fluid ounce; syrup*, 6 *fluid ounces; clarified honey*, 3 *ounces. Rub the powders with the syrup and the honey into a uniform mass, then add the oils, and mix.*

PILULA SCAMMONII COMPOSITA—COMPOUND SCAMMONY PILL.—*Take of resin of scammony, resin of jalap, curd soap, in powder, of each* 1 *ounce; strong tincture of ginger*, 1 *fluid ounce; rectified spirit*, 2 *fluid ounces. Add the spirit and tincture to the soap and resins, and dissolve with the aid of a gentle heat; then evaporate the spirit, by the heat of a water-bath, until the mass has acquired a suitable consistence for forming pills.*

PULVIS SCAMMONII COMPOSITUS—COMPOUND POWDER OF SCAMMONY.—*Take of scammony resin, in powder*, 4 *ounces; jalap, in powder*, 3 *ounces; ginger, in powder*, 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally, rub it lightly in a mortar.*

Therapeutics.—Scammony acts as a drastic hydragogue cathartic, causing considerable local irritation in the bowels. It is useful as a derivative purgative in head cases and in dropsies; as a vermifuge, and as a brisk cathartic for children, either alone or in combination with small doses of rhubarb or calomel. It is especially indicated in cases in which there is torpidity of the abdominal viscera, and is contra-indicated in irritable and inflammatory conditions of the stomach and bowels. In large doses it may give rise to dangerous symptoms, or even prove fatal.

Adulterations or Substitutions.—*The Root.*—Belladonna root is not unlike scammony root, but it is much smaller. Other roots have been found substituted for it, but they neither show resin on the fractured surface nor does the tincture yield it. *Scammony* is said to be frequently adulterated by the natives, who mix foreign articles with the soft substance—chalk (effervesces with acids), flour (blue with iodine), wood ashes, earthy matters, ordinary resin, wax, plumbago, gypsum, &c. (all detected by the behaviour to ether and water). *Resin of Scammony.*—Guaiacum resin (detected by rendering blue the cut surface of a potato) and resin of Jalap (insoluble in ether) may be found as adulterants.

Ipomœa Purga—Jalap.

JALAPA—*Jalap.*—The dried tubercles of *Ipomœa Purga*, Hayne—(*Exogonium Purga*, Bentham).

Characters and Test.—Irregularly oblong, somewhat ovoid napiform, or rarely fusiform, hard, compact, varying much in size, the larger frequently incised or cut into halves or quarters. Externally, dark-brown, more or less irregularly furrowed and wrinkled, and marked with paler coloured transverse lines or scars ; internally, dirty yellowish or brownish, and frequently marked with dark-brown irregular concentric circles. Odour faint, peculiar, and smoky, increased by rubbing or powdering ; taste sweetish, acrid, and nauseous. Treated as for the preparation of Resin of Jalap, not less than 10 per cent. of resin[1] should be obtained, of which not more than one-tenth should be soluble in ether.[2]

Dose.—10 to 30 grains.

[1] Shows that it is of good quality, and that the resin has not been extracted. [2] Absence of more than the proportion of jalapin present in true Jalap.

Active Principles.—*Resin* (which see), about 12 to 20 per cent., to which the drug owes its efficacy, and in addition *gum*, *starch*, *colouring matter*, and *a non-crystalline sugar* are found.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Extractum.	Coarse Powder.	2 in 1 (about).	5 to 15 grains.
Pulvis Compositus.	Fine "	1 in 3.	20 to 60 "
Resina.	No. 40 "	Yields 15 to 20 per cent.	2 to 5 "
Tinctura.	" " "	1 in 8.	½ to 2 fluid drms.

Also contained in *Pulvis Scammonii Compositus* (3 in 8).

EXTRACTUM JALAPÆ—Extract of Jalap.—*Take of jalap, in coarse powder,* 1 *pound; rectified spirit,* 4 *pints; distilled water,* 1 *gallon. Macerate the jalap in the spirit for seven days; press out the tincture, then filter, and distil off the spirit, leaving a soft extract. Again macerate the residual jalap in the water for four hours, express, strain through flannel, and evaporate by a water-bath to a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding* 140° *F.* (60° *C.*), *until it has acquired a suitable consistence for forming pills.*

The maceration in spirit extracts the active resins, and the maceration in water extracts inert substances, such as colouring matter, starch, gum, sugar, &c., which are added to the former, and so make really a diluted resin.

PULVIS JALAPÆ COMPOSITUS—Compound Powder of Jalap.—*Take of jalap, in powder,* 5 *ounces; acid tartrate of potash,* 9 *ounces; ginger, in powder,* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally, rub it lightly in a mortar.*

TINCTURA JALAPÆ—Tincture of Jalap.—*Take of jalap, in No.* 40 *powder,* 2½ *ounces; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

JALAPÆ RESINA—Resin of Jalap.—*Take of jalap, in No.* 40 *powder,* 8 *ounces; rectified spirit and distilled water, of each a sufficiency. Prepared as for resin of scammony* (which see).

Characters and Tests.—In dark-brown opaque fragments, translucent at the edges, brittle, breaking with a resinous fracture, readily reduced to a pale-brown powder, sweetish in odour, acrid in the throat, easily soluble in rectified spirit, insoluble in oil of turpentine.[1] The powder yields little or nothing to water,[2] and not more than 10 per cent. to ether.[3]

[1] Absence of common rosin. [2] Absence of inert substances, such as gum, starch, &c. [3] Shows only the amount of jalapin present in true jalap.

Contained in *Pilula Scammonii Composita* (1 in 3¼).

Active Principles.—About nine-tenths of the *Resin* are insoluble in ether; this has been called *Convolvulin* (*Jalapurgin* or *Rhodeoretin*), $C_{31}H_{50}O_{16}$, a colourless, inodorous, tasteless body, but its alcoholic solution has an acrid taste. It is nearly insoluble in ether, chloroform, benzol, carbon disulphide, and volatile oils, but is soluble in alkalies, acetic and cold nitric acids. *Convolvulin* is the anhydride of *Convolvulic Acid*, $C_{62}H_{106}O_{35}$, into which body caustic alkalis convert it. *Convolvulic Acid*, like *Convolvulin*, is a glucoside, and boiling with dilute mineral acids convert both into *glucose* and *Convolvu-*

linol, $C_{26}H_{50}O_7$, the latter a bitter, crystalline body, which caustic alkalis convert into *Convolvulinolic Acid*, $C_{26}H_{48}O_6$, a crystalline substance sparingly soluble in water. The final products of the oxidation of all the foregoing are *Oxalic and Sebacic Acids*, $H_2C_2O_4$ and $C_{10}H_{18}O_4$. The part soluble in ether is called *Jalapin* or *Para-rhodeoretin*, $C_{34}H_{56}O_{16}$. It is the chief constituent of spurious Jalap, but should not be present in Resin of Jalap in more than 10 per cent. It is like *Convolvulin* in many ways, but differs in being soluble in ether, chloroform, and benzol. It is brown in colour, acid in reaction, acrid in taste, soluble in caustic alkalis, from which acids reprecipitate it (this differs from *Convolvulin*). Caustic alkalis convert it into *Jalapic Acid*, $C_{68}H_{118}O_{35}$, soluble in water. *Jalapic Acid*, when boiled with dilute mineral acids, is converted into an acrid body named *Jalapinol*, $C_{32}H_{62}O_7$; and alkalis, on the other hand, turn it into *Jalapinolic Acid*, $C_{32}H_{60}O_6$. The final product of the oxidation of all the above is the same as with *Convolvulin*. *Jalapin* and *Scammonin* are identical substances.

Therapeutics.—Jalap acts as a powerful drastic purgative, producing copious liquid evacuations, and occasionally causing nausea and griping, but this may be partly obviated by combining with carminatives. It is usually a safe medicine for children, but in overdoses may give rise to excessive purging and inflammation. It is given to overcome habitual constipation, as a hydragogue cathartic in dropsies, especially in the form of the compound powder, as an anthelmintic, as a derivative purgative in head affections, &c. It is useful also as a purgative in febrile and inflammatory affections, as it causes neither vascular excitement nor constitutional disturbance.

Adulterations or Substitutions.—Jalap is said to be frequently adulterated, but the exact characters given in the Pharmacopœia are sufficient to detect any substitution. The chief substitutions are the two following :—1. Tampico Jalap, the product of *Ipomœa simulans*, Hanbury, is more shrivelled up, lighter in weight, smaller in size, more elongated, and more tapering, and it yields a *resin* or *glucoside* entirely soluble in ether (*Jalapin*). 2. Woody Jalap, Orizaba Root, Light, Fusiform, or Male Jalap, or Jalap Tops or Stalks, the product of *Ipomœa Orizabensis*, Ledanois, is found in irregular, angular, or circular pieces, which are portions of the true root, or in some cases entire small roots, and they are always fusiform in shape. It is paler, more woody, lighter, and more shrivelled than the true jalap. It also yields about 12 per cent. of a *Resin* soluble in ether (*Jalapin*). Jalap of inferior quality, and containing little or no resin, is occasionally to be found. This is likely due to carelessness in the collection; but in America Jalaps have been sold which were evidently deprived of their resin before being thrown on the market.

Resin of jalap may be adulterated with water to increase its weight, in which case it will lose weight on being exposed on a water-bath for some time. It should yield nothing to water, showing absence of the gum, colouring matter, &c., which may remain after imperfect washing. Other resins, such as Jalapin, are shown by the solubility in ether. Rosin is shown by its solubility in oil of turpentine, and is said to be occasionally found. Guaiacum resin may be an adulterant, but the blue colour which it strikes with the fresh-cut surface of potato renders its presence evident. Aloes is not unlike resin of jalap, and may be mistaken for it, and is also sometimes used to adulterate. Its bitter taste and the yellow colour of picric acid which is produced when it is touched with nitric acid makes its presence clear.

Ipomœa Nil, Linn.—Kaladana (*Pharbitis Nil*, Choisy)—(*not official*)—official in the I.P.—Found in Africa, America, and India. The seeds (the part used) are black in colour, about $\frac{1}{4}$ of an inch long, having a sweetish acrid taste and an earthy odour. They contain chiefly a *fixed oil* and a resin, called *Pharbitisin*, which is the active principle, and is *insoluble* in ether and corresponds to *Convolvulin*, the active principle in true Jalap. The powdered seeds are used in place of jalap, are not quite so active, but in their medicinal properties much resemble that substance. The dose of the seeds is 30 to 50 grains, and of Pharbitisin 2 to 8 grains.

Nat. Ord. **SOLANACEÆ**—The Potato Order.—Herbs or shrubs, widely distributed, but abounding within the tropics. The order furnishes edible tubers and fruit, and medicines which are characterised by tonic, pungent, or stimulant properties. Divided into two sub-orders—(1) *Solaneæ*, in which the aestivation of the corolla is valvate or induplicate; (2) *Atropeæ*, in which it is imbricate or a modification thereof.

Official Plants.

	Botanical Name	Parts Used.	Habitat.
Solaneæ.	CAPSICUM FASTIGIATUM.	Dried ripe fruit.	Zanzibar.
Atropeæ.	ATROPA BELLADONNA.	Fresh and dried leaves and dried root.	Britain, Germany.
	DATURA STRAMONIUM.	Dried leaves and seeds.	,, ,,
	HYOSCYAMUS NIGER.	Fresh leaves and flowers with branches. Dried leaves and flowering tops.	Britain.
	NICOTIANA TABACUM.	Dried leaves.	America.

SUB-ORDER I.—SOLANEÆ.

Capsicum fastigiatum—Capsicum—East Indian Capsicum—Chillies—Bird Pepper—Guinea Pepper—Cayenne.

CAPSICI FRUCTUS — *Capsicum Fruit.*—The dried ripe fruit of *Capsicum fastigiatum*, Blume, imported from the coast of Guinea and from the East and West Indies, and known in commerce as Guinea pepper and pod pepper.

The variety of Capsicum growing in Zanzibar is *C. frutescens*, the Shrubby Capsicum, producing the bird's-eye chillies, and forming the basis of cayenne pepper.

Characters.—From about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long and $\frac{1}{4}$ of an inch in diameter; somewhat shrivelled, oblong-conical, obtuse,[1] and composed of a smooth, shining, brittle, thin, translucent pericarp of a dull orange-red colour, enclosing several small roundish or ovoid flat[2] seeds. Taste of both pericarp and seeds intensely pungent; odour peculiar and pungent.

[1] Fruit of *Capsicum annuum* is ovate or nearly sub-globose, and is 2 or 3 inches long. [2] Seeds of *C. annuum* are reniform.

Active Principles.—*Capsaicin*, $C_9H_{14}O_2$, a crystalline, colourless, volatile, and very acrid body, soluble in alcohol, ether, benzol, and fixed oils, is found in small amount, and is the most important. A *volatile oil*, a *volatile alkaloid* having the odour of conine, and *colouring matter* are also known, in addition to *fixed oil*, *resin*, *wax*, &c. The body known as *Capsicin* is a mixture of capsaicin, resin and fat, and *Capsicol* is somewhat similar.

Official Preparation.

Name.	Part Used.	Strength.	Dose.
Tinctura.	Bruised fruit.	1 in 27.	10 to 20 minims.

TINCTURA CAPSICI—TINCTURE OF CAPSICUM.—*Take of capsicum fruit, bruised, ¾ ounce; rectified spirit, 1 pint. Made by maceration and percolation.*

TINCTURA CAPSICI FORTIOR—STRONGER TINCTURE OF CAPSICUM, B.P.C.—(*not official*).—*Take of capsicum fruit, in No. 40 powder, 10 ounces; rectified spirit, a sufficiency. Macerate for 24 hours, then percolate until 1½ pint is obtained.* Sometimes called LINIMENT OF CAPSICUM.

Dose.—1 to 3 minims. Chiefly used externally.

The above may be diluted with rectified spirit to make the official tincture.

TINCTURA CAPSICI ÆTHEREA—ETHEREAL TINCTURE OF CAPSICUM—(*not official*).—Made with ether and of the same strength as the official tincture.

EMPLASTRUM CAPSICI FLUIDUM—FLUID PLASTER OF CAPSICUM—(*not official*).—*May be made by making an ethereal tincture double the official strength, and diluting with an equal volume of Flexible Collodion.*

UNGUENTUM OLEO-RESINÆ CAPSICI — OINTMENT OF OLEO-RESIN OF CAPSICUM, B.P.C.—(*not official*).—*Take of oleo-resin of capsicum (prepared by exhausting capsicum fruit with ether, distilling off the latter, and straining to reject the fatty matter), 1 ounce; yellow wax, ½ ounce; benzoated lard, 4 ounces. Melt the wax and lard at a low temperature, add the oleo-resin, mix thoroughly, and if necessary strain through muslin. Stir till cold. As a mild counter-irritant, this ointment will bear dilution from 3 to 6 times.* Sometimes called CHILLIE PASTE.

Cayenne Pepper is the product of the powdered fruit of *C. fastigiatum*, *C. annuum* and other species. Soluble Cayenne Pepper is common salt mixed with oleo-resin (*Capsicin*) and coloured with annatto or other harmless agent.

Therapeutics.—Capsicum acts as an acrid stimulant in moderate doses, and as an irritant poison in over-doses. Externally, it acts as a rubefacient, and may be applied in the form of the ointment, the ethereal tincture or fluid plaster to itching chilblains and chronic rheumatic or other painful affections. It is largely used as a condiment, and, as a medicine, is employed chiefly for the sake of its local stimulant action upon the mucous membrane of the mouth, throat, and stomach. It may be given in atonic dyspepsia, and in all cases in which it is desirable promptly to arouse the stomach from a feeble or sluggish condition. The tincture is used as an adjunct to gargles in relaxed or septic sore throat. The disagreeable tingling in the throat and œsophagus produced by swallowing capsicum may be markedly relieved or removed by slowly sipping butter-milk. The dose of the powder is 5 to 10 grains.

Adulterations or Substitutions.—Capsicum fruit can hardly be said to be adulterated. *C. annuum* (described below) is like it, but the fruit is larger. The powder known as Cayenne Pepper is occasionally adulterated with red lead and other heavy coloured metallic salts, which are easily detected by the microscope or by ignition.

Capsicum annuum—Pod Pepper.—Capsicum (*Syn.*, *C. longum*,[1] D. C. ; *C. grossum*,[1] Willd ; *C. cordiforme*,[1] Mill)—(*not official*).—Is a native of South America. The powdered fruit probably supplies much of the Cayenne Pepper of commerce.

[1] These are by some regarded as varieties of *C. annuum.*

Characters of the fruit—(*not official*).—It is flattened, shrivelled, 2 or 3 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ inch broad. In form it is oblong-conical and tapers towards the apex, and at the base are the remains of the stalk and calyx. The colour is yellowish-red and the pericarp is tough and leathery. The seeds are reniform and much larger than those of *C. fastigiatum.* The taste is like that of the official species. Odour, none or almost none. Its *active principles and therapeutics* are the same as *C. fastigiatum.*

Solanum Dulcamara — Bitter-sweet — Woody Nightshade — (*not official*).

Botany.—*Root,* woody. *Stem,* shrubby, twining, flexible. *Leaves,* acute, generally smooth, entire at the margins, the lower ones cordate, the upper hastate. *Inflorescence,* racemose ; corolla purple, with two green spots at the base of each segment, of which there are five. *Fruit,* a scarlet berry, juicy, and many-seeded. *Habitat,* indigenous; in hedgerows and woods in this and other European countries. *Flowering time,* June and July.

DULCAMARA—*Dulcamara.*—The dried young branches, from indigenous plants which have shed their leaves, of *Solanum Dulcamara,* Linn. (*Dulcamara flexuosa,* Moench)—(*not official*).

Characters.—Light, hollow, cylindrical, about the thickness of a goose-quill, bitter, and subsequently sweetish to the taste.

Active Principles.—The glucoside *Dulcamarin*, $C_{22}H_{34}O_{10}$, imparts the bitter and sweet taste; an amorphous alkaloid, supposed to be *Solanine*, is also present, with *resin*, *gum*, *starch*, &c.

Therapeutics.—Dulcamara is said to act as a deobstruent, anodyne, demulcent, and alterative, and in over-doses as an acro-narcotic, but its action is obscure and feeble. It has been used in a variety of cases, the decoction forming a convenient vehicle for other medicines, as in chronic pulmonary complaints, in chronic cutaneous diseases, &c. It was formerly official but is little used now; an infusion (1 in 10) may be given in 1 to 4 ounce doses.

SUB-ORDER II.—ATROPEÆ.

Atropa Belladonna—Belladonna—Deadly Nightshade—Dwale.

Botany.—*Root*, perennial, thick, fleshy, branched, often a foot or more in length. *Stems*, herbaceous, annual, 3 to 5 feet high, branched, downy, of a reddish tinge. *Leaves*, alternate, 4 or 5 inches long, often in pairs of unequal size, broadly ovate, acute. *Flowers*, solitary, stalked, drooping, about 1 inch in length; corolla campanulate, greenish towards the base, but dark-purple towards the extremity. *Berry*, of a shining violet-black colour, two-celled, about the size of a small cherry, and containing numerous reniform seeds embedded in a mawkish pulp. *Habitat*, indigenous; growing in waste and shady places. It flowers in June and July, and the berries ripen in September.

BELLADONNÆ FOLIA—*Belladonna Leaves.*—The fresh leaves with their branches attached, also the dried leaves separated from the branches of *Atropa Belladonna*, Linn., gathered in June when the fruit has begun to form, from wild or cultivated British plants.

Characters and Test.—Leaves alternate, 3 to 8 inches [1] long, ovate, acute, entire,[2] smooth, all shortly stalked, the uppermost in pairs and unequal, fœtid when bruised. The expressed juice or an infusion dropped into the eye dilates the pupil.[3]

BELLADONNÆ RADIX—*Belladonna Root.*—The dried root of *Atropa Belladonna*, Linn., cultivated in Britain or imported from Germany.

Collection, &c.—The root should be collected in February or March or in October, preferably in February or March, for then it is most active. Plants from 2 to 3 years old are best, and the small-sized root is therefore usually better than larger pieces, and should, if possible, be obtained. The drying should be conducted with care, by gentle heat, to avoid the destruction of the active principles.

Characters and Test.—In rough, irregular branched pieces, from 1 to 2 feet long, and from ½ to 2 or more inches thick, generally marked at their upper end by the hollow bases of the stems which they once bore. The root is covered with a dirty grey or brownish integument, which is easily scraped off by the nail, when the exposed surface presents a whitish appearance. It breaks readily with a short fracture, and the surface is then seen to consist of a thin cortical portion of a yellowish or pale brown colour, separated by a dark line from a large central portion of a brownish colour, and marked throughout by scattered darker-coloured dots. The root-branches without evident medullary rays. An infusion dropped into the eye dilates the pupil.[3]

[1] This marks them out from *S. Dulcamara*, the leaves of which are smaller, and have long stalks. [2] *S. nigrum* has serrated leaves. [3] This is not peculiar to Belladonna, for Hyoscyamus, &c., do the same. One might question the wisdom of inserting and making official a test which might be productive of much discomfort from being indiscriminately applied.

Active Principles.—The leaves contain *Atropine*, about ½ per cent., some *Hyoscyamine*, *Belladonnine*, and probably *Asparagin*, along with *wax*, *albumin*, &c. The root contains the same three alkaloids as the leaves, atropine being present in about the same amount, and chiefly in the bark. Ladenburg believes, however, that hyoscyamine is really present in the plant, and that it becomes altered to atropine during extraction.

Official Preparations from the Leaves.

Name.	Parts Used.	Strength.	Dose.
Extractum.	Fresh leaves and young branches.	Yields about 4 per cent.	¼ to 1 grain.
Succus.	,, ,,	3 of juice in 4.	5 to 15 minims.
Tinctura.	Dried leaves.	1 in 20.	5 to 20 ,,

EXTRACTUM BELLADONNÆ—Extract of Belladonna.—*Take of the fresh leaves and young branches of belladonna*, 112 *pounds*. *Prepared according to the directions given for Green Extracts.* (See Extract of Aconite.)

This preparation must be carefully distinguished from the Alcoholic Extract, which is prepared from the root and is much stronger in akaloids. Squire gives the alkaloidal strength of the green extract as ranging from 0·73 to 1·17 per cent.

SUCCUS BELLADONNÆ—JUICE OF BELLADONNA.—*Take of fresh leaves and young branches of belladonna*, 7 *pounds; rectified spirit, a sufficiency.*

The directions given under Succus Conii apply here.

TINCTURA BELLADONNÆ—TINCTURE OF BELLADONNA.—*Take of belladonna leaves, in No.* 20 *powder*, 1 *ounce; proof spirit*, 1 *pint. Prepared by maceration and percolation.*

Sixty minims are in strength equal to 1 grain of the extract (Squire).

GLYCERINUM BELLADONNÆ—GLYCERINE OF BELLADONNA, B.P.C.—(*not official*).—*Take of extract of belladonna*, 1 *ounce; boiling distilled water*, 1 *fluid drachm. Rub together in a mortar to produce a smooth paste, and then add glycerine to produce* 2 *fluid ounces.*

SUPPOSITORIUM BELLADONNÆ—SUPPOSITORY OF BELLADONNA—(*not official*).—*Made with cacao butter and extract of belladonna, the latter being first rubbed down with a little water, so as to form a smooth paste; afterwards gradually add the melted cacao butter, and rub up till a homogeneous mass is obtained, and pour into moulds.*

The suppository may be made to contain from $\frac{1}{2}$ to 2 grains of the extract.

Official Preparations from the Root.

Name.	Parts Used.	Strength.	Dose.
Atropina.	Root.	...	...
Extractum Alcoholicum.	No. 20 powder.	...	$\frac{1}{16}$ to $\frac{1}{4}$ grain.
Linimentum.	No. 40 powder.	1 in $1\frac{1}{2}$.	...

EXTRACTUM BELLADONNÆ ALCOHOLICUM — ALCOHOLIC EXTRACT OF BELLADONNA.—*Take of belladonna root, in No.* 20 *powder*, 1 *pound; rectified spirit and distilled water, of each a sufficiency. The root is macerated for forty-eight hours with* 2 *pints of spirit, then percolated, and the percolation continued with water until* 2 *pints of liquid have been collected. The alcoholic extract is then evaporated to pilular consistence.*

This extract has been found to contain alkaloids from 1·7 to 4·45 per cent., which is too wide a range of variability, and shows carelessness either in collecting the root or in preparing the extract. It would be better to have a standardised extract.

Official Preparations.

Name.	Part Used.	Strength.
Emplastrum.	Alcoholic extract.	1 in 5
Unguentum.	" "	1 in 10

EMPLASTRUM BELLADONNÆ — BELLADONNA PLASTER. — *Take of alcoholic extract of belladonna,* 4 *ounces; resin plaster and soap plaster, of each* 8 *ounces. Melt the plasters by the heat of a water-bath, then add the extract, and mix the whole thoroughly together.*

UNGUENTUM BELLADONNÆ—OINTMENT OF BELLADONNA. —*Take of alcoholic extract of belladonna,* 50 *grains; benzoated lard,* 1 *ounce. Rub the extract smooth with a few drops of distilled water, then add the lard, and mix thoroughly.*

LINIMENTUM BELLADONNÆ—LINIMENT OF BELLADONNA. —*Take of belladonna root, in No.* 40 *powder,* 20 *ounces; camphor,* 1 *ounce; rectified spirit, a sufficiency to make* 30 *fluid ounces.*

The directions and notes given under Liniment of Aconite apply here.

CHLOROFORMUM BELLADONNÆ—CHLOROFORM OF BELLADONNA, B.P.C.—(*not official*).—*Take of belladonna root, bruised,* 20 *ounces; stronger solution of ammonia,* 1½ *fluid ounce; distilled water,* 1 *pint; chloroform, a sufficiency. Mix the water, ammonia, and root together, macerate for four hours, dry carefully, and reduce to No.* 40 *powder. Pack in a tight-fitting percolator, macerate for twenty-four hours with* 20 *fluid ounces chloroform, then percolate slowly, and add chloroform till* 30 *fluid ounces have been collected.*

The ammonia is added to neutralise the malic acid, and so set free alkaloids which are dissolved by the chloroform. The preparation is practically a solution of the alkaloids in chloroform.

COLLODIUM BELLADONNÆ—COLLODION OF BELLADONNA. —(*Syn.* Emplastrum Belladonnæ Fluidum), B.P.C.—(*not official*).—*Take of alcoholic extract of belladonna,* 5 *ounces; spirit of camphor,* 2½ *fluid ounces; dissolve, and add flexible collodion sufficient to make 1 pint. Set aside, and decant the clear liquid.*

Atropina.—Atropine, $C_{17}H_{23}NO_3$.—The following is a summary of the pharmacopœial process. (See the Pharmacopœia.)

1. Dissolve out the Atropine (present as malate) by means of maceration and percolation with rectified spirit.

2. Add slaked lime to neutralise malic acid, with which the atropine is united, and so set free the pure alkaloid; filter, and add dilute sulphuric acid to form soluble Atropine Sulphate, recover part of the spirit by distillation, and remove the remainder by evaporation.

3. Carefully neutralise with potassium carbonate, and set aside for impurities to separate out.

4. Filter to separate impurities, add excess of potassium carbonate to again set free the alkaloid, and shake up with chloroform, which dissolves the Atropine.

5. Separate the chloroform solution, and distil off the chloroform. Dissolve the residue in warm rectified spirit.

6. Shake up with animal charcoal to free from colouring matters.

Finally, filter, evaporate, cool, and crystallise till colourless crystals are obtained.

Characters and Tests. — In colourless acicular crystals, sparingly soluble in water,[1] more readily in alcohol and in ether. Its solution in water has an alkaline reaction, gives a citron-yellow precipitate with perchloride of gold,[2] has a bitter taste, and powerfully dilates the pupil. It leaves no ash when burned with free excess of air.[3] It is an active poison.

[1] Squire gives its solubilities as 1 in 500 of Water; 1 in 3 Rectified Spirit; 1 in 25 Ether; 1 in 1 Chloroform; 1 in 52 Glycerine; and 1 in 15 Oleic Acid. [2] Shows it is an alkaloid. [3] Absence of inorganic impurities.

Chemistry.—When atropine is heated with hydrochloric acid or with baryta water, it is decomposed into *Tropic Acid* and *Tropine*, $C_{17}H_{23}NO_3 + H_2O = C_9H_{10}O_3 + C_8H_{15}NO$. Chemically, tropic acid is closely allied to cinnamic and benzoic acids; while tropine is an alkaloid. They may be recombined to form atropine, and by using different acids, a whole series of such alkaloids, called *tropeines*, may be prepared.

Official Preparations of Atropine.

Name.	Part Used.	Strength.	Dose.
Atropinæ Sulphas.	Pure alkaloid.	... ...	$\frac{1}{100}$ to $\frac{1}{20}$ grain.
Unguentum.	,, ,,	8 grains in 1 ounce.	... ...

UNGUENTUM ATROPINÆ—OINTMENT OF ATROPINE.—*Take of atropine,* 8 *grains; rectified spirit,* ½ *fluid drachm; prepared lard,* 1 *ounce. Dissolve the atropine in the spirit, add the lard, and mix thoroughly.*

ATROPINÆ SULPHAS — SULPHATE OF ATROPINE, $(C_{17}H_{23}NO_3)_2H_2SO_4$.—*Take of atropine,* 120 *grains; distilled water,* 4 *fluid drachms; diluted sulphuric acid, a sufficiency. Mix the atropine with the water, and add the acid gradually, stirring them together until the alkaloid is dissolved and the solution is neutral. Evaporate it to dryness at a temperature not exceeding* 100° *F.* (37°·8 *C.*).

Characters and Tests.—A nearly colourless powder, soluble in water, forming a solution which is neutral[1] to test paper, and when applied to the eye dilates the pupil. It leaves no ash when burned with free access of air.[2]

[1] Showing there is no excess of alkaloid or of acid. [2] Absence of inorganic matters.

Official Preparations of Sulphate of Atropine.

Name.	Strength.	Dose.
Liquor.	About 1 per cent.	1 to 4 minims.
Lamella.	$\frac{1}{5000}$ grain in each.	... ...

LIQUOR ATROPINÆ SULPHATIS—SOLUTION OF SULPHATE OF ATROPINE.—*Take of sulphate of atropine,* 9 *grains; camphor water,* 16½ *fluid drachms. Dissolve.*

LAMELLÆ ATROPINÆ — DISCS OF ATROPINE. — *Discs of gelatine, with some glycerine, each weighing about* $\frac{1}{50}$ *grain, and containing* $\frac{1}{5000}$ *grain of sulphate of atropine.*

Used in dilating the pupil of the eye.

Homatropinæ Hydrobromas—Hydrobromate of Homatropine, $C_{16}H_{21}NO_3HBr$.—The hydrobromate of an alkaloid prepared from tropine. (See Atropine.)

Characters and Tests.—A white crystalline powder or aggregation of minute prismatic crystals, soluble in 6 parts of cold water and in 133 parts of ethylic alcohol. The dilute aqueous solution powerfully dilates the pupil of the eye. Heated on platinum foil, it fuses and burns without leaving an appreciable residue.[1] If 2 minims of chloroform be shaken with 10 minims of a 10 per cent. aqueous solution, and chlorine water be cautiously added, the chloroform will assume a brownish colour.[2] A 2 per cent. aqueous solution is not precipitated by the cautious addition of solution of ammonia previously diluted with twice its volume of water.[3] About $\frac{1}{10}$th of a grain, moistened with 2 minims of nitric acid and evaporated to dryness on the water-bath, yields a residue which is coloured yellow by an alcoholic solution of potash.[4] If about $\frac{1}{10}$th of a grain be dissolved in a little water, and the solution be made alkaline with ammonia and shaken with chloroform, the separated chloroform will leave on evaporation a residue which will turn yellow, and finally brick-red, when warmed with about 15 minims of a solution of 2 grains of perchloride of mercury in 100 minims of proof spirit.[5]

Dose.—$\frac{1}{80}$ to $\frac{1}{20}$ grain.

[1] Absence of inorganic impurities. [2] Owing to setting free of bromine and showing the salt is a hydrobromate. [3] Morphine would give a precipitate. [4] It forms toluic acid, $C_8H_8O_2$. [5] This may be called the chemical test for the mydriatics, for it is given by Atropine, Homatropine, Daturine, Hyoscyamine, and Duboisine. Most other alkaloids give a white precipitate.

LAMELLA HOMATROPINÆ HYDROBROMATIS—Disc of Homatropine Hydrobromate—(*not official*).—*Of the same strength as that of atropine.*

Incompatibles.—The caustic alkalis, because they decompose the alkaloids; the carbonates or bicarbonates may, however, be prescribed.

Therapeutics.—Belladonna belongs to the class of deliriant narcotics, in common with henbane, stramonium, &c. In over-doses it is poisonous, producing, more or less, the following symptoms:—Dryness of the mouth and throat, hoarseness of voice, complete or partial aphonia, ineffectual attempts at vomiting, excessive dilatation of the pupils, and paralysis of accommodation with impaired vision, eyes suffused, face benumbed, singing in the ears, or other noises in the head; deglutition is difficult, or impossible; pulse is very much accelerated ; palpitation of the heart, weakness of the limbs, tendency to syncope, giddiness, great general excitement, and a disposition to fight, laugh, or talk ; inability to control the movements of the muscles by any effort of the will, catching at imaginary objects in the air, incoherent replies to questions, &c. The saliva and sweat are diminished, while the urine is increased. This stage is followed by a condition of coma, which may end in death. The pulse, in fatal cases, gets more and more rapid, intermittent, and weak. Recovery is ushered in by a repetition of the symptoms of mirthful delirium. There is sometimes an eruption upon the skin resembling that of scarlatina ; strangury is often observed. The characteristic symptoms are dryness of the throat, dilatation of the pupil, perversion of vision, and mirthful delirium. Recovery is gradual, and the patient has no recollection of his previous condition ; the pupil is slowly restored, and there remains marked nervous depression for a considerable time. Poisoning not unfrequently occurs from eating the berries, plucked from the plant, in ignorance of their action. In one case seven berries caused well-marked symptoms of poisoning.

Medicinally, belladonna is employed as an anodyne, hypnotic, antispasmodic, mydriatic, diuretic, and stimulant.

As an *anodyne*, it acts by paralysing the ends of the motor and sensory nerves, and is useful in local nervous pains, such as tic-douloureux, cardiac neuralgia, pain from inflammatory swelling, in the pain resulting from pressure of internal aneurism, in intercostal neuralgia, in lumbago, myalgia, orchitis, and chordee, in pruritus, herpes zoster, and boils, dysmenorrhœa, irritable uterus, uterine cancer, &c. ; in incontinence of urine due to hyperæsthesia of the bladder. For its full anodyne effects, the local application of the medicine should be combined with its internal administration. For its local effects upon the pelvic organs atropine is frequently administered in suppositories or pessaries, with or without other medicament, such as hydrochlorate of morphine, &c. Each pessary should contain about $\frac{1}{20}$th of a grain of atropine.

As an *hypnotic*, it may be employed as a substitute for opium, but it is not nearly so certain in its action. Dr John Harley asserts that, given in combination with opium or morphine, it greatly enhances the hypnotic effects of the opiate, while it diminishes the disagreeable after-effects.

As an *antispasmodic* in asthma, hooping-cough, laryngismus stridulus, and in spasmodic coughs generally, in epilepsy and chorea, in spasmodic stricture of the urethra, in rigidity of the cervix uteri, in spasm of the sphincter ani, in certain cases of incontinence of urine, in chordee, to correct the griping of various medicines, in habitual constipation, &c.

As a *mydriatic*, it is employed in ophthalmic surgery to dilate the pupil, acting by paralysis of the oculo-motor nerve-endings in the circular fibres of the iris. Atropine or its sulphate is generally used for this purpose, and is of value in facilitating ophthalmoscopic examination, to prevent or restore prolapse of the iris in wounds of the cornea, to prevent or break up adhesions, to allay pain and inflammation in ulcer of the cornea and conjunctivitis, to facilitate operation for cataract, &c. Atropine discs or a drop of the liquor may be applied for these purposes. The dilatation begins in about 20 minutes, and lasts from two to four days, causing a good deal of inconvenience to the patient from impairment of vision. Besides dilating the pupil, the extract of belladonna, when smeared over the eyebrow, at the same time greatly diminishes the browache so frequently attendant upon inflamed conditions of the eye.

As a *diuretic*, it is possessed of considerable reputation, and is strongly recommended by Dr John Harley, who gives a large number of cases in evidence of this action of belladonna.

As a *vasculo-cardiac stimulant*, it is used in syncope from asthenia and from shock, in the collapse of cholera, in failure of the heart's action from chloroform, aconite, colchicum, and other cardiac paralysers (atropine being introduced subcutaneously); in poisoning from opium, it stimulates the respiratory centres as well as the circulatory system, and is so far antagonistic to the action of opium ; in depressed conditions during continued fevers, &c.

Belladonna also is largely employed to arrest the secretion of milk, the plaster, glycerine, or an ointment being applied directly to the mamma. Excessive salivary secretion arising during pregnancy, from mercurials, or any other cause, is successfully controlled by it. The night sweats of phthisis and hyperhidrosis generally are diminished or wholly arrested by its use. In all these cases it acts by paralysing the terminations of the secretory nerves in the glands.

It has been given in scarlet fever, but is of no special benefit. It is of value as an antagonist to opium, physostigmine, and pilocarpine. Homatropine has much the same action as atropine, but in a much milder degree, and practically is only used to dilate the pupil. A 1 per cent. solution or a lamella may be applied ; for general use it is more convenient than atropine, as the dilatation passes off during the course of one day.

Treatment of Poisoning.—If the belladonna or atropine have been swallowed, wash out the stomach or give emetics. Calabar bean

($\frac{1}{6}$ to $\frac{1}{4}$ grain of the extract) or morphine should be given hypodermically, and stimulants administered.

Adulterations or Substitutions.—Belladonna leaves may be mistaken for those of *Hyoscyamus niger*, which are hairy, or of *Datura Stramonium*, which are minutely wrinkled; those of *Solanum Dulcamara* are much smaller and supported on a long leaf-stalk, and often the two small pinnæ may be seen at their bases; those of *Solanum nigrum* are considerably smaller, not acutely acuminated, and have their edges serrated. Belladonna root is not unlike *Pyrethrum*, which has a thick bark, on which are seen resin receptacles, the fractured surface has a radiating appearance, and the whole root is tapering, and gives the prickling sensation when chewed; Scammony Root has its outer surface longitudinally furrowed, when fractured, fragments of resin are seen, and the odour is sweetish. *Mandragora officinalis* (*Atropa Mandragora*), Mandrake, indigenous to Southern Europe, is somewhat like belladonna, but has a thick bark, is brown externally, white internally, and the taste is sharp and bitter; it contains poisons of the *atropine* group. *Scopolia Japonica*, or Japanese Belladonna, has been met with, and may be described as follows:—It is a rhizome about 4 inches long and $\frac{1}{2}$ an inch thick, and shows stem and root scars. Externally it is brown and dark, and internally it is pale-brown, with white dots here and there. It has an odour not unlike hemlock, and its taste is bitter. It contains *Scopoline*, probably a mixture of *atropine*, *hyoscyine*, and *hyoscyamine*. The dose is the same as that of *atropine*. It causes as much dilatation of the pupil as atropine, and its effects last much longer. Atropine and its sulphate are not subject to adulteration.

Scopola Carniolica—Scopola—(*not official*).—The root of this plant, a native of Austria, has been offered as a substitute for belladonna; it owes its activity to *Hyoscyamine*, which is present to the extent of 0·43 per cent. A solid extract (*dose*, $\frac{1}{8}$ to $\frac{1}{2}$ grain), containing 2 per cent.; a liquid extract (*dose*, 1 to 5 minims), containing $\frac{1}{4}$ per cent.; and a tincture (*dose*, 5 to 30 minims), containing $\frac{1}{25}$ per cent. of alkaloid are employed. For external use, a liniment, plaster, and ointment have been suggested.

Datura Stramonium.—Stramonium—Thorn Apple.

Botany.—An indigenous herbaceous annual, growing in waste places. *Root*, large, white, fibrous. *Stems*, much branched, smooth, fetid. *Leaves*, large, unequal at the base, ovate, unequally sinuate-dentate. *Flowers*, axillary, erect, white, giving off an agreeable odour, especially at night. Flowers in July. *Fruit*, a capsule, 2 to 3 inches long, covered with spines, ovate in shape, four-celled in the lower portion, two-celled above, opening by four valves, and containing numerous seeds.

STRAMONII FOLIA—*Stramonium Leaves.*—The dried leaves of *Datura Stramonium*, Linn.

Characters.—Ovate, petiolate, about 6 inches long, smooth, unequal at the base, one side decurrent down the petiole, coarsely and sinuately angular toothed, minutely wrinkled,[1] dark-green.[2] The upper surface usually brownish-green, and of a darker shade than the under surface; odour faintly narcotic, taste unpleasant, saline and bitter.

[1] This is different from belladonna leaves. [2] The petiole and nerves of the leaves of *D. Tatula* are purplish.

STRAMONII SEMINA—Stramonium Seeds.—The dried ripe seeds of *Datura Stramonium*, Linn.

Characters.—About $\frac{1}{6}$ inch long, reniform,[1] flattened, brownish-black,[2] deeply pitted, wrinkled. Odour disagreeable when bruised; taste bitterish.

[1] Those of *D. alba* are auricular. [2] *D. alba* seeds are yellowish-brown.

Active Principles.—The alkaloid found in the leaves and seeds has been called *Daturine*, but Ladenburg asserts that this body is a mixture of hyoscyamine and atropine. The seeds contain about 25 per cent. *fixed oil*, *resin*, &c. being also present.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Extractum.	No 40 powder.	...	$\frac{1}{4}$ to $\frac{1}{2}$ grain.
Tinctura.	Bruised seeds.	1 in 8.	10 to 30 minims.

EXTRACTUM STRAMONII — EXTRACT OF STRAMONIUM.—*Take of stramonium seeds, in No.* 40 *powder*, 1 *pound; ether*, 1 *pint, or a sufficiency; distilled water, proof spirit, of each a sufficiency. Shake the ether in a bottle with half-a-pint of the water, and after separation decant the ether. Pack the stramonium in a percolator, and free it from its oil by passing the washed ether slowly through it. Having removed and rejected the ethereal solution, pour the spirit over the residue of the stramonium in the percolator, and allow it to pass through slowly until the powder is exhausted. Distil off most of the spirit from the tincture, and evaporate the residue by a water-bath until the extract has acquired a suitable consistence for forming pills.*

TINCTURA STRAMONII—TINCTURE OF STRAMONIUM.—*Take of stramonium seeds, bruised, $2\frac{1}{2}$ ounces; proof spirit, 1 pint. Prepared by maceration and percolation.*

DATURINÆ SULPHAS — SULPHATE OF DATURINE — (*not official*). (See *Active Principles.*)

Dose.—$\frac{1}{100}$ to $\frac{1}{20}$ grain.

Incompatibles.—Same as for Belladonna.

Therapeutics.—The action of stramonium is similar to that of belladonna, both in small and large doses. It has been employed as an anodyne in neuralgic, rheumatic, and other painful conditions. As an antispasmodic it is largely used in asthma, the leaves being smoked in a pipe, and it is a constituent of a large number of secret remedies for asthma. Otherwise it is not much used in medicine.

Treatment of Poisoning.—Same as in case of belladonna.

Adulterations and Substitutions.—As already noticed, stramonium leaves resemble belladonna leaves, and may be confounded with them. Hyoscyamus leaves are whitish and hairy, and only in a small degree resemble those now under discussion. *Datura Tatula*, Linn., is by some only regarded as a variety of the official Stramonium. In appearance it differs as follows:—The stem, petiole, and nerves of the leaves are purplish instead of green, and the flowers are purple instead of white. It grows in the same localities as the official drug, and its active ingredients and therapeutics are the same. Its seeds cannot be distinguished from those of *D. Stramonium*. *Datura alba*, Nees, has seeds not unlike those of *D. Stramonium*. They are described below.

Datura Alba—Indian or White-flowered Datura—(*not official*).—Indigenous to India. The seeds and leaves are employed. The seeds are yellowish-brown, irregular in shape, shrivelled, the hilum running from the pointed end nearly half-way up the length of the seed. The leaves are 6 to 10 inches long, with long stalks, ovate, unequal at the base, acuminate, dentate. Odour offensive. No analysis has been made, but probably the active ingredient is *Daturine*.

Therapeutically, the plant is the same as *D. Stramonium*, but it is seldom employed in regular practice.

Hyoscyamus niger—Henbane—Hyoscyamus.

Botany.—The plant is usually biennial, but under favourable circumstances it is annual. *Root*, spindle-shaped. *Stem* is usually simple, or but little branched, hirsute, 1 to 3 feet high. *Leaves*, large, dull-green, unequally sinuate, downy, clammy, and have a fetid odour ; the radicle leaves only appear in the first year, and the other leaves with their stems appear in the following spring. *Flowers*, numerous, unilateral, drooping, nearly sessile ; corolla and calyx funnel-shaped ; corolla dull straw colour, reticulated with dark-purple veins. *Fruit*, capsular, with small, roundish, yellowish-grey, and finely-dotted seeds. The biennials flower in June, the annuals a little later ; seeds ripen from August to October. *Habitat*, indigenous, waste places and commons in England, but is not native to Scotland, although it has been found in one or two places.

In commerce the dried plants are found as (1) the Annual Plant—leaves and tops ; (2) Biennial Plant, with leaves of the first year ; (3) Biennial Plant, with its leaves and green tops, and this latter is alone official—that is, the biennial plant in its second year.

HYOSCYAMI FOLIA — *Henbane Leaves.* — The fresh leaves and flowers, with the branches to which they are attached, of *Hyoscyamus niger*, Linn. (*H. agrestis and pallidus*, Kit), also the leaves, separated from the flowering tops, carefully dried. Collected from biennial plants, growing wild or cultivated in Britain, when about two-thirds of the flowers are expanded.

Characters and Test.—Leaves varying in length, sometimes as much as 10 inches, with or without a stalk, alternate, exstipulate, triangular-ovate or ovate-oblong, acute, undulated, irregularly toothed, sinuated, or pinnatifid, pale-green, and glandular-hairy, particularly on their under surface. The branches are sub-cylindrical, and also glandular-hairy. The fresh herb has a strong heavy odour, a bitter and slightly acrid taste, and the juice, when dropped into the eye, dilates the pupil.[1]

[1] Due to the presence of Hyoscyamine, but Atropine, Daturine, Duboisine, and Homatropine produce the same result.

HYOSCYAMI SEMEN—*Hyoscyamus or Henbane Seed—(not official).*—Chiefly used in preparing the alkaloid. They are about $\frac{1}{16}$th inch long, reniform, and flattened in shape ; grey-brown in colour, and pitted. The albumen is whitish, enclosing a curved embryo. They have no odour, but an oily, bitter, acrid taste.

Active Principles.—The alkaloid *Hyoscyamine*, present as malate, is the most important. It is more abundant in the seeds than in the leaves, and may be obtained by the same process as for atropine. It is isomeric with atropine, $C_{17}H_{23}NO_3$, but is not identical with it, and when treated with caustic alkalis at the ordinary temperature it is converted into atropine. Hyoscyamine is sparingly soluble in water, freely in ether, chloroform, and alcohol. Treated with baryta, or hydrochloric acid, it splits up into *Hyoscine* and *Hyoscinic Acid*, regarded by Ladenburg as identical with tropine and tropic acid. The name *Hyoscine* has also been applied to another alkaloid found in henbane, and which forms the greater part of the amorphous Hyoscyamine of commerce, being an isomer of that alkaloid. It is the *Sikeranine* of Buckheim, and on decomposition yields *tropic acid* and *pseudo-tropine.* It is this alkaloid which is used in medicine under the name *Hyoscine. Hyoscypicrin*, $C_{27}H_{52}O_{14}$, a glucoside, *choline*, *albumen*, &c., are also found.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Extractum.	Fresh leaves, young branches, and flowering tops.	Yields about 5 per cent.	5 to 10 grains.
Succus.	" " "	3 of juice in 4.	$\frac{1}{2}$ to 1 fluid drachm.
Tinctura.	Dried leaves or flowering tops in No. 20 powder.	1 in 8.	$\frac{1}{2}$ to 1 fluid drachm.

EXTRACTUM HYOSCYAMI — EXTRACT OF HYOSCYAMUS. — *Take of the fresh leaves and young branches of hyoscyamus*, 112 *pounds. Prepared according to the directions given for Green Extracts.* (See Extract of Aconite.)

SUCCUS HYOSCYAMI—JUICE OF HYOSCYAMUS.—*Take of fresh leaves and young branches of hyoscyamus*, 7 *pounds; rectified spirit, a sufficiency. The directions and notes are the same as for Succus Conii* (which see).

TINCTURA HYOSCYAMI—TINCTURE OF HYOSCYAMUS.—*Take of hyoscyamus leaves or flowering tops, in No.* 20 *powder*, $2\frac{1}{2}$ *ounces; proof spirit*, 1 *pint. Prepared by maceration and percolation.*

HYOSCYAMINÆ SULPHAS PURA—PURE SULPHATE OF HYOSCYAMINE, $(C_{17}H_{23}NO_3)_2H_2SO_4$—(*not official*).

Dose.—$\frac{1}{100}$ to $\frac{1}{30}$ grain.

The crude article is a mixture of Hyoscyamine and Hyoscine. The pure sulphate is official in the U.S.P.

HYOSCINÆ SULPHAS—SULPHATE OF HYOSCINE—(*not official*) —$(C_{17}H_{23}NO_3)_2H_2SO_4$. (See *Active Principles.*)

Dose.—$\frac{1}{120}$ to $\frac{1}{60}$ grain.

Incompatibles.—As for Belladonna.

Therapeutics.—The action of henbane is very similar to that of belladonna and stramonium, but it is more calmative and hypnotic, this being due to the alkaloid known as hyoscine. From belladonna and stramonium it also differs in being less active, and its preparations are given in much larger doses. Poisonous doses show essentially the belladonna action, and are followed by dilatation of the pupil and disturbance of vision, mirthful or furious delirium, coma; sometimes nausea, vomiting, and purging; the face is often distorted, and there is often more or less paralysis, with occasional convulsive movements. In small and repeated doses it acts as a calmative, tranquillising the patient, and allaying general and local nervous irritability and excitement, producing sleep by its soothing influence upon the nervous system. It is employed as a sedative in cough, and in irritation of the genito-urinary organs, as well as to relieve pain and procure sleep in a variety of cases. It may be given as a substitute for opium in cases in which the latter is an objectionable remedy. It is occasionally also used as an antispasmodic, but is inferior to belladonna and stramonium. Topically, by fomentation or cataplasm, or by the application of the extract, it may be used as an anodyne to painful swellings, hæmorrhoids, neuralgic and rheumatic pains, &c., but is often unavailing. It is frequently combined with purgatives to correct their irritating and griping qualities. It may be given in moderate doses to children to allay the irritation produced by teething, when there is a tendency to convulsions; and here, like belladonna, it is relatively well borne.

Hyoscyamine and its salts can be used in the same way as atropine.

Hyoscine differs greatly from hyoscyamine or atropine in action, and exerts chiefly a sedative effect on the central nervous system. In doses of $\frac{1}{150}$ to $\frac{1}{60}$ grain, subcutaneously, it has been used with success in the insomnia and delirium of insanity and delirium tremens, in nervous and sexual excitement, and as an antispasmodic.

Treatment of Poisoning.—Same as in case of Belladonna.

Adulterations or Substitutions.—Inert leaves due to careless drying are perhaps most important. *H. albus* is occasionally found in place of *H. niger*. It is known by its being more slender, having stalked leaves and bracts. *H. insanus* or Mountain Hemp, is smoked in India in place of Hyoscyamus, and is alleged to be very active. Belladonna and stramonium leaves have already been mentioned as somewhat resembling hyoscyamus. The seeds are not unlike those of belladonna, but the latter are red-brown in colour. A case of poisoning due to hyoscyamus seed having been sold by a herbalist for celery seed is reported in the *B.M.J.* of May 21, 1892. This is an adulteration not likely to occur often, because the latter, although of the same size, are greenish-brown, ribbed, have oil tubes, and an aromatic odour.

Duboisia myoporoides, R. Br. — Duboisia — Indigenous to Australia—(*not official*).—The leaves are the parts used, and are alternate, short-stalked, smooth, 2 to 4 inches long, and $\frac{1}{2}$ to 1 inch broad, lanceolate, entire and revolute on the margin, inodorous and with a bitter taste. The active principle is *Duboisine*, said to be identical with *Hyoscyamine*. It also contains a volatile alkaloid, *Piturine*, C_6H_8N, soluble in alcohol, water, and ether, which in many ways resembles *Nicotine*. Duboisine sulphate is employed in ophthalmic practice as a mydriatic, and of the strength of 1 grain to 1 ounce of distilled water. Except as a mydriatic its use has been limited. The *dose* is $\frac{1}{120}$ to $\frac{1}{30}$ grain.

Duboisia Hopwoodii—Pituri or Pedgery—(*not official*).—Also a native of Australia, yields *Piturine* (see D. myoporoides). It is used like tobacco by the aborigines.

Nicotiana Tabacum—The Tobacco Plant—Cultivated Tobacco —Virginian Tobacco.

TABACI FOLIA—*Tobacco Leaves.*—The dried leaves of *Nicotiana Tabacum*, Linn. (*N. macrophylla*, Lehm. ; *N. auriculata*, Bert ?).

Collection, &c.—In August the stems of the plant are cut close to the roots, and hung up to dry at a considerable temperature, during which time they " sweat." After sweating has passed off, the leaves are stripped from the stems and packed for exportation.

During the curing process, the leaves undergo fermentation, acquire a brownish colour, and develop their characteristic smell and flavour. The chemical changes which occur are very complex, and, no doubt, vary somewhat according to the different details followed in making different varieties of tobacco.

Characters and Tests.—Large, being sometimes more than 20 inches long ; ovate, ovate-lanceolate, or oval-oblong, acute entire, bearing numerous brown, short glandular hairs ; having a peculiar heavy odour, and nauseous, bitter, acrid taste ; yielding, when distilled with solution of potash, a liquid alkaloid, which has the peculiar odour of nicotine, and precipitates with perchloride of platinum[1] and tincture of galls.[1]

[1] Shows it to be an alkaloid.

Active Principles.—*Nicotine*, $C_{10}H_{14}N_2$ (2–9 per cent.), is a volatile, oily, liquid alkaloid, present as *malate*, and may be obtained by distilling with potash, as mentioned above. It has a specific gravity of 1·027, boils at 247° C., and is liquid at even − 10° C. When exposed to the air it becomes brown, gradually absorbs oxygen, and becomes thick. It is soluble in water, ether, alcohol, and oils. It is inflammable, has a strong odour and an acrid burning taste. The watery distillate of the leaves yields *Nicotianin or Tobacco Camphor*, an acicular crystalline body having a peculiar taste and a tobacco-like smell. In addition to the above, *gum*, *resin*, *albumin*, *&c.*, *phosphates*, *nitrates*, *malates*, and *citrates of potassium and lime* are present. There is an unusual amount of ash.

When smoked, tobacco yields nicotine, various bases of the pyridine and chinoline series, bodies of the phenol series, sulphuretted hydrogen, carbonic oxide, ammonia, sulphocyanide of ammonium, marsh gas, &c. The action is chiefly due to the nicotine and other bases. The practice of tobacco-smoking is of unknown antiquity among the aborigines of North and South America, and was introduced into Europe by sailors about the end of the 16th century. In spite of opposition from governments and other authorities, it rapidly spread over European and Eastern countries.

Therapeutics.—Tobacco acts as a very active poison, causing nausea, vomiting, and often purging, utter prostration of muscular power; heart's action greatly reduced, pulse small, weak, fluttering, and almost imperceptible; face pale, extremities cold, great anxiety, muscular tremors; pupils contracted, vision impaired, respiration more or less laboured, and the entire body bathed in a cold clammy sweat; paralysis, with occasional convulsive movements and stupor, lead to death. In smaller doses, tobacco acts as a sedative and antispasmodic, somewhat as a diuretic, and as an emetic and laxative; but very minute doses and the smoking of tobacco most probably stimulate the nervous system. The poisonous effects are due to its local irritant action, to its depressing the functions of the spinal cord and paralysing the motor nerves, death being due to asphyxia from interference with the respiratory function. As an emetic, its action is both direct and indirect, and its purgative power is due to its exciting tetanic contractions of the intestines. Tobacco is not now used medicinally, in consequence of its violent action. It has been given with various results in strangulated hernia, ileus, tetanus, spasmodic asthma, and strychnine poisoning, rigidity of the os uteri, spasm of the sphincter ani, and other conditions, as an antispasmodic; as a diuretic in dropsies; as a topical application in a variety of skin diseases; as an anthelmintic, &c. The habit of tobacco-smoking in some individuals, especially when largely indulged in, leads to functional irregularity of the heart, weakening of the cardiac action, tremors, disagreeable nervous symptoms, gastric derangements, and amblyopia. These pass off readily enough if smoking be stopped and nux vomica or strychnine be given in moderate doses.

An enema of tobacco (20 grains in 8 ounces boiling water and strain) was formerly official, but is not so now.

Treatment of Poisoning.—Emetics or wash out stomach, give alcoholic stimulants, ammonia, and strychnine.

Nat. Ord. **SCROPHULARIACEÆ**—Herbs or under-shrubs, universally distributed.

Official Plant.

Botanical Name.	Part Used.	Habitat.
DIGITALIS PURPUREA.	Dried leaves.	Indigenous.

Digitalis purpurea—Foxglove—Digitalis.

Botany.—Herbaceous, biennial, or perennial. *Stem*, erect, 3 or 4 feet high, simple, roundish, slightly angular, and downy. *Leaves*, alternate, downy, dull green, ovate-lanceolate or oblong, and ramified with veins. *Inflorescence*, racemose, terminal, erect, one-sided. *Flowers* (do not appear till the second year), numerous, pendulous, inodorous; corolla campanulate, crimson, internally hairy, and marked with eye-like spots. *Seeds*, small, roundish, somewhat angular, greyish-brown. *Habitat*, indigenous, growing in pastures, hedgerows, and upon banks. *Flowering-time*, June and July.

DIGITALIS FOLIA—*Foxglove Leaves.*—The leaves of *Digitalis purpurea*, Linn. (*D. tomentosa*, Link. and Hoffm.). Collected from wild[1] British plants of the second year's growth, when about two-thirds of the flowers are expanded,[2] and carefully dried.[3]

Characters.—From 4 to 12 or more inches in length, and sometimes as much as 5 or 6 inches broad, with a winged petiole of varying length; ovate or ovate-lanceolate, sub-acute, crenate or irregularly crenate-dentate, somewhat rugose, slightly hairy[4] and dull green above, densely pubescent and paler beneath. Taste very bitter,[5] unpleasant; odour faint, agreeable, and tea-like. The dried leaves and powder are prone to change, losing their medicinal properties by keeping; they should, therefore, be kept from the influence of air and light, and should be renewed annually.

Dose.—$\frac{1}{4}$ to $1\frac{1}{2}$ grain.

[1] They are more active than the cultivated. [2] Most active at this season (see Belladonna). [3] The active principle is easily decomposed by heat. [4] *Verbascum* has a thick coat of hairs. [5] *Verbascum* is feebly bitter, and *Symphytum* not at all.

Active Principles.—Formerly in the B.P. a mixture of the active principles was official under the name of *Digitalin*, but it has been excluded on account of its varying composition and strength. This body represented the earliest success in obtaining the active principles, and is known as *Homolle's Digitalin.* Afterwards Homolle and Quevenne showed it to be a mixture, and described it as consisting of three bodies, which they named *Digitalin*, *Digitaline*, and *Digitalose.* Later, Nativelle extracted *Crystalline Digitalin*, *Digitalein*, and *an inert crystalline substance.* Walz, Tanret, and many other investigators have also described, under various names, a number of bodies which they have isolated. Great confusion existed as to the nomenclature and identity of these substances, but the matter has been to a considerable extent cleared up by the later researches of Schmiedeberg. Schmiedeberg obtained from commercial digitalin, made from digitalis seeds, four bodies, which he named *Digitoxin*, *Digitalin*, *Digitalein*, and *Digitonin.* Digitoxin is a crystalline body, insoluble in water, soluble in hot alcohol, less so in cold, and identical with Nativelle's crystalline digitalin. It is not a glucoside, and when heated with dilute mineral acids decomposes into the amorphous *Toxiresin.* Digitalin and digitaleïn are glucosides, both soluble in alcohol, the latter soluble in water, the former only slightly so. All these substances have the characteristic actions of digitalis, but the first is much more powerful than the other two. Digitonin is a glucoside, soluble in water and alcohol, and having the physiological action of saponin, not that of digitalis. Schmiedeberg has further shown that *French (or Homolle's) digitalin* consists of digitoxin along with other bodies in small amount, that *Nativelle's digitalin* is practically pure digitoxin, and that the so-called *German digitalin* is digitalein.

Official Preparations.

Name.	Parts Used.	Strength.	Dose.
Infusum.	Dried leaves.	1 in 156.	2 to 4 fluid drachms.
Tinctura.	Leaves in No. 20 powder.	1 in 8.	5 to 30 minims.

INFUSUM DIGITALIS—Infusion of Digitalis.—*Take of digitalis, dried,* 28 *grains; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for a quarter of an hour, and strain.*

TINCTURA DIGITALIS—Tincture of Digitalis.—*Take of digitalis leaves, in No.* 20 *powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

This Tincture becomes inert by long keeping.

Amorphous Digitalin (D. of Homolle) is given in doses of $\frac{1}{60}$ to $\frac{1}{30}$ grain, or as digitalin granules $\frac{1}{60}$ grain in each; crystallised Digitalin (Nativelle's) in the same dose; Digitalein in the same dose; Digitoxin in somewhat smaller amount.

Incompatibles.—Salts of the heavy metals. Although iron preparations strike a black colour with the infusion and tincture owing to the presence of tannin, the two are not physiologically incompatible.

Therapeutics.—Digitalis is a tonic and stimulant to the heart and circulation when given in moderate doses. The heart beats more slowly and powerfully, diastole and systole are more complete and prolonged, there is contraction of the arterioles, and as a result the blood pressure is raised. If the dose be increased, the action of the heart becomes embarrassed from the ventricular contractions being too forcible and prolonged, diastole is incomplete, and the blood pressure falls, hence the results of this over-stimulation lead to imperfect action of the heart and failure of the circulation. This explains how the slow, regular pulse after a moderate dose of the remedy, becomes small, intermittent, and irregular after a large dose. The symptoms of an over-dose are those of failure of cardiac action—viz., giddiness, pallor of the surface, syncope, dilated pupils, pulse small and irregular, often rapid, usually accompanied with abdominal pain, vomiting and purging. Fatal cases terminate by collapse, occasionally attended with unconsciousness, suppression of urine, and convulsions.

As to the *modus operandi* of the drug on the heart and circulation, it acts as a direct stimulant to the cardiac muscle itself, and to the roots of the cardiac-inhibitory fibres of the vagus. It may slightly stimulate the sympathetic, but this action is comparatively feeble, and is soon overcome by the more powerful action on the vagus. It also causes contraction of the arterioles, probably from a direct action on their muscular coats, with the total result that the cardiac beats become slower and more powerful, and the blood pressure is increased.

Therapeutically, digitalis is principally employed in heart disease and dropsy from loss of cardiac power. In a weak heart, from whatever cause, when the organ is unequal to its work, and disturbance of its action and embarrassment of the circulation follow, digitalis is invaluable in restoring the balance of the circulation and thus relieving the symptoms, hence its value in valvular disease, dilatation, fatty heart, palpitation, irregular action, and weakness from fevers, anæmia, lung conditions, &c. It should not be given in valvular disease, so long as compensation is good, but as soon as the clinical symptoms indicate that the heart is beginning to fail, digitalis is of benefit in all forms of valvular disease. The results obtained from it are much more satisfactory in mitral incompetence than in other cardiac conditions, but even in aortic disease it is of benefit if compensation has begun to fail. As a guide to the employment of digitalis, it is evident that a knowledge of the relation of the heart to the work required is much more important to the physician than the nature of the cardiac lesion.

In virtue of its action on the circulation, digitalis is a diuretic in dropsy, especially from heart disease; that is to say, its action is indirect, and is due to increase of arterial tension and regulation of the distribution of the arterial and venous blood, not to any stimulating action on the kidneys. Its action is comparatively slow, but is persistent when it does occur. This slow action of digitalis as a diuretic, and the fact long ago pointed out by Withering—viz., that it succeeds best when the pulse is feeble and intermitting, face pale, and lips livid, is another proof of the stimulant effect of the drug on the heart and circulation; the amount of urine passed is to a certain extent a guide for the safe administration of the drug, because whenever its stimulant action is excessive, and the heart and circulation begin to be embarrassed, the amount of urine diminishes. The urine diminishes, however, in any case as soon as the dropsy has passed off. As a diuretic, it may be well combined with squill, or with squill and blue pill. It is also useful, though not so efficacious, in cases of dropsy into serous cavities, as into the peritoneum. In the latter condition a strong infusion, applied externally, is said greatly to aid the internal administration.

Digitalis may also be given with advantage in pneumonia, emphysema, and other lung diseases which embarrass the action of the heart. As a cardiac stimulant in syncope from hæmorrhage, poisoning with aconite, and other depressing poisons, it may be given by the mouth or hypodermically. When given hypodermically the active principles cause a good deal of local irritation, and hence this method of administration is advisable only in an emergency.

Digitalis has a *cumulative action*, that is, it is excreted very slowly, tends to accumulate in the body, and thus suddenly to produce symptoms of poisoning. Its administration, therefore, needs to be carefully watched, and intermitted if necessary from time to time.

Treatment of Poisoning.—Wash out the stomach, keep the patient recumbent and completely at rest, and administer alcoholic stimulants, atropine hypodermically, nitrites and ammonia in such quantities as may be necessary.

Adulterations or Substitutions.—Matico leaves somewhat resemble those of digitalis as one finds them in the dried condition, but have the whole surface between the secondary nerves traversed with a small tessellated reticulation of veins. The leaves of *Verbascum Thapsus*, Linn., great mullein, are recognised by the thick layer of branched stellate hairs; those of *Inula Conyza*, D.C., ploughman's spikenard, and *I. Helenium*, Linn., Elecampane, have been substituted. Both have almost entire margins, and elecampane has the veins diverging at right angles from the mid-rib. Another common plant has also been substituted, namely, *Symphytum officinale*, Linn., comfrey, but the leaves, like those of mullein, are hairy on both sides, and all of the afore-mentioned lack the bitter taste of digitalis leaves.

Veronica virginica—Leptandra—(*not official*).—The rhizome is the part used, and is known in the United States, to which it is indigenous, as Culver's Root or Culver's Physic. The rhizome is about 4 to 6 inches long and $\frac{3}{8}$ inch thick, usually branched, externally deep blackish brown, internally blackish, with a broad yellowish circle of wood, many thin rootlets, no odour, taste bitter and slightly acrid.

The *active principles* are a bitter substance, *Leptandrin*, crystalline and soluble in water, alcohol, and ether; *resin* (about 6 per cent.), *tannin*, *mannite*, *gum*, and other substances. The so-called *Leptandrin* used in medicine is a resinous extract of uncertain composition, which is cathartic in doses of about 5 to 10 grains, and in smaller doses, $\frac{1}{4}$ to 2 grains, is reputed to be cholagogue, but probably has simply a mildly laxative action.

Verbascum Thapsus, Linn. — Mullein — Great Mullein — (*not official*).

Botany.—*Biennial. Stem*, 4 to 5 feet high. *Leaves*, ovate-oblong, crenate, densely woolly on both sides, all decurrent, and 4 to 8 inches long. *Inflorescence*, dense spikes, with broad bright-yellow flowers. *Habitat*, indigenous on waste ground. *Flowering time*, July and August.

The leaves of this and other species are the parts used, and they have already been mentioned as adulterants of digitalis leaves

Their constituents are *volatile oil*, *gum*, *sugar*, *colouring matter*, and what seems most important, *mucilage*. An infusion (1 in 20), in 2 to 4 ounce doses, is used to allay cough, in diarrhœa, in irritation of the urinary passages, and warm, as a soothing application to painful piles.

Nat. Ord. **PEDALIACEÆ or SESAMEÆ** — The Pedalium Order.—Chiefly tropical plants, with very oily seeds; none of them are official.

Sesamum indicum and **S. orientale**, Linn.—The Sesamé plant, a native of India, but now cultivated in many warm parts of the globe. The seeds are $\frac{1}{8}$ to $\frac{1}{6}$ inch long, and $\frac{1}{12}$ inch broad, flattish ovate; testa, black or purplish-brown to pale-brown or whitish-yellow; inodorous, taste bland. They yield about 50 per cent. of a fixed oil, known as *Sesamé*, *Benne*, *Til*, or *Gingili Oil*, and, in addition, contain *mucilage* (4 per cent.), *proteids* (22 per cent.), and *ash*. The best oil is pale-yellow in colour, almost without smell, and with an agreeable taste. It is not a drying oil, and keeps a particularly long time without becoming rancid.

Therapeutics.—Is used for the same purposes as olive oil, especially in India, but is not so pleasant, nor so digestible. The seeds are largely used as food in Africa, India, &c.

Nat. Ord. **LABIATEÆ or LAMIACEÆ** — The Labiate or Dead-Nettle Order.—Herbs or under-shrubs, inhabiting temperate climates. The medicinal properties of the plants are due to the presence of volatile oil, to which also they owe their fragrance; they are chiefly employed as carminatives and antispasmodics.

Official Plants.

Botanical Name.	Parts Used.	Habitat.
LAVANDULA VERA.	Distilled oil.	England.
MENTHA PIPERITA.	Distilled oil and Stearoptene.	Britain.
,, VIRIDIS.	Distilled oil.	,,
,, ARVENSIS, *vars.* PIPERASCENS & GLABRATA.	Stearoptene.	China, Japan, and United States.
ROSMARINUS OFFICINALIS.	Distilled oil.	South of Europe. Cultivated in England.
THYMUS VULGARIS and MONARDA PUNCTATA.	Stearoptene.	Chiefly cultivated in France.

Lavandula vera—Lavender.

Botany.—An under-shrub, 1 to 3 feet in height, with oblong-linear, or lanceolate, entire leaves. *Inflorescence*, interrupted spikes ; flowers, purplish-grey, in whorls of six to ten flowers. *Flowering time*—July and August. *Habitat*, south of Europe ; largely cultivated at Mitcham in Surrey, at Market Deeping in Lincolnshire, and Hitchin in Hertfordshire.

Oleum Lavandulæ—*Oil of Lavender.*—The oil distilled in Britain from the flowers of *Lavandula vera*, D.C. The yield is about 1½ per cent.

Characters. — Pale-yellow, or nearly colourless, with the very fragrant odour of the flowers, and a hot, bitter, aromatic taste.

Dose.—1 to 4 minims.

Constituents.—The oil has a specific gravity of about 0·900 ; it contains the *terpene* $C_{10}H_{16}$, the *stearoptenes* $C_{10}H_{16}O$ and $C_{10}H_{18}O$, and *formic*, *acetic*, and *butyric ethers* of these.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Spiritus.	Oil.	1 in 50.	½ to 1 fluid drachm.
Tinctura Composita.	,,	1½ drachm in 2 pints.	½ to 2 fluid drachms.

Also contained in *Linimentum Camphoræ Compositum* (1 in 160, about).

Adulterations.—The oil of *Lavandula Spica*, D.C., and of *L. Stoechas*, Linn., oil of turpentine, and alcohol may all be used as adulterants. The two former are less fragrant and more camphoraceous in odour ; oil of turpentine makes it less soluble in alcohol. Alcohol is detected by distillation and other well-known tests already mentioned.

Therapeutics.—Lavender is used as an aromatic stimulant and carminative, and as a flavouring agent for mixtures. As lavender water (a solution in strong alcohol) it is largely employed as a perfume and deodorant.

Mentha piperita—Peppermint.

Botany.—Perennial herb. *Root*, creeping. *Stem*, erect, smooth, quadrangular. *Leaves*, ovate-oblong, acute, serrated, smooth. *Inflorescence*, lax spikes ; flowers violet-coloured. *Odour* and *taste*, highly aromatic. *Flowering-time*, July and August. *Habitat*, indigenous, rare, wet places ; extensively cultivated at Mitcham in Surrey, and some other places in England.

OLEUM MENTHÆ PIPERITÆ—*Oil of Peppermint.*—The oil distilled in Britain from fresh flowering peppermint, *Mentha piperita*, Sm. (*M. officinalis* and *M. hircina*, Hull).

Characters.—Colourless, pale-yellow, or greenish-yellow when recent, but becoming gradually thicker and reddish by age, with the odour of peppermint,[1] and a strong, penetrating, aromatic taste, followed by a sensation of coldness in the mouth.[2]

Dose.—1 to 4 minims.

[1] The addition of 2 or 3 per cent. of alcohol very markedly preserves the odour of the oil for a lengthened period. [2] Due to the contained stearoptene menthol.

Active Principles.—When oil of peppermint is cooled down to $-4°$ C., it yields the body called *Peppermint Camphor* or *Menthol*, $C_{10}H_{19}OH$, which is, however, not peculiar to peppermint, and is described later. After removal of the solid *Menthol*, there is left the liquid portion, about which little is known, but in it is found an *oxygenated body* isomeric with *borneol*, $C_{10}H_{18}O$. In addition to these the oil contains *hydrocarbons*, $C_{10}H_{16}$ and $C_{15}H_{24}$, which have a lemon-like odour. When fresh the oil is neutral, and turns a ray of light to the left. The specific gravity of the oil is about 0·900, and it gives some chemical colour reactions which are dependent on its liquid portion. A small quantity of glacial acetic acid added to it, and heated, gives a blue colour to transmitted and a blood-red to reflected light. Picric acid dissolved in it is gradually coloured reddish.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Oil.	1½ fluid drachm to 1 gallon.	1 to 2 fluid ounces.
Essentia.	,,	1 in 5.	10 to 20 minims.
Spiritus.	,,	1 in 50.	½ to 1 fluid drachm.

Also contained in *Pilula Rhei Composita* (1 in 60 nearly); *Tinctura Chloroformi et Morphinæ* (1 in 960 nearly).

AQUA MENTHÆ PIPERITÆ—PEPPERMINT WATER.—*Take of oil of peppermint,* 1½ *fluid drachm; water,* 1½ *gallon. Distil* 1 *gallon.*

Peppermint water is a constituent of *Mistura Ferri Aromatica.*

ESSENTIA MENTHÆ PIPERITÆ—Essence of Peppermint.—*Take of oil of peppermint*, 1 *fluid ounce; rectified spirit*, 4 *fluid ounces. Mix.*

SPIRITUS MENTHÆ PIPERITÆ—Spirit of Peppermint.—*Take of oil of peppermint*, 1 *fluid ounce; rectified spirit*, 49 *fluid ounces. Dissolve.*

Therapeutics.—Peppermint acts as an aromatic stimulant, carminative, stomachic, and antispasmodic, and as such its preparations are given either alone or with other medicines, to disguise their taste and odour, or to correct their irritating and griping qualities, although in the case of young children it appears to cause intense tormina now and again. They are also much used to overcome flatulence. It possesses antiseptic properties, due to the presence of the menthol chiefly, and it acts as a local anæsthetic in myalgic and neuralgic pains by paralysing the sensory nerve-terminations.

Adulterations or Substitutions.—Alcohol, castor-oil, wax, and oil of turpentine have been added to the oil. The three latter affect the solubility in alcohol (oil of peppermint is clear in 1 to 3 of 80 per cent. alcohol). Alcohol is detected as mentioned under Lavender. Oil of Erigeron is oftener an adulterant in America than in this country, and makes the oil resinify more readily and gives it a disagreeable heavy odour.

Mentha Viridis—Spearmint—Common Garden Mint—Mackerel Mint.

Botany.—Perennial herb. *Root*, creeping. *Stem*, erect, smooth. *Leaves*, opposite, ovate-lanceolate, sessile, smooth. *Inflorescence*, loose spikes. *Flowering time*, August. *Habitat*, indigenous, in marshy places, rare.

Oleum Menthæ Viridis—*Oil of Spearmint.*—The oil distilled in Britain from fresh flowering spearmint, *Mentha viridis*, Linn. (*M. Spicata*, Crantz; *M. Sylvestris*, var. *glabra*, Koch).

Characters of the Oil.—Colourless, pale-yellow, or greenish-yellow when recent, but becoming reddish by age, with the odour and taste of spearmint.[1]

Dose.—1 to 4 minims.

[1] As in the case of peppermint the addition of 3 or 4 per cent. of alcohol preserves the odour.

Constituents.—Spearmint oil contains a large amount of *stearoptene* and a *hydrocarbon*, $C_{10}H_{16}$, isomeric with oil of turpentine, as well as an *oxidised body*, to which the odour of the plant is due, isomeric with *carvol* (see Caraway), $C_{10}H_{14}O$, but differing from *carvol* in being levogyrate. Oil of spearmint has the specific gravity of 0·914 and a boiling point of 160° C.

Official Preparation.

Aqua, $1\frac{1}{2}$ fluid drachm of oil to 1 gallon. *Dose.*—1 to 2 fluid ounces.

AQUA MENTHÆ VIRIDIS—SPEARMINT WATER.—*Take of oil of spearmint,* $1\frac{1}{2}$ *fluid drachm; water,* $1\frac{1}{2}$ *gallon. Distil* 1 *gallon.*

Therapeutics.—Spearmint acts as an aromatic stimulant, carminative, and stomachic, and as such the water is employed as a vehicle for other medicines. It is the "peppermint" of many confectioners, and is used in cookery.

Adulterations or Substitutions.—Horse-mint oil is largely distilled in various parts of the United States, and appears to correspond with that found in this country. In Germany *M. aquatica* or Capilate Mint (so called because it has a capilate inflorescence) is distilled and yields an oil similar to the official British oil.

Rosmarinus officinalis—Rosemary.

Botany.—A leafy shrub, about 4 feet high. *Leaves,* opposite, sessile, linear, hoary beneath. *Inflorescence,* short axillary racemes; flowers, greyish-blue or lavender-coloured. *Flowering time,* April and May. *Habitat,* south of Europe; cultivated in England.

OLEUM ROSMARINI—*Oil of Rosemary.*—The oil distilled from the flowering tops of *Rosmarinus officinalis,* Linn.—*Syn.* Oleum Anthos.

The great bulk of the oil found in commerce is obtained from the south of France or the neighbouring parts of Italy. The Pharmacopœia directs only the flowering tops to be used, but most of the oil found in the market is distilled from the entire herb.

Characters.—Colourless or pale-yellow, with the odour of rosemary, and a warm aromatic taste.

Constituents.—The oil consists largely of the *terpene* $C_{10}H_{16}$, and the *oxidised hydrocarbons* $C_{10}H_{16}O$ and $C_{10}H_{18}O$. It is levogyre, has a specific gravity of 0·900, and is soluble in half its volume of rectified spirit.

Official Preparation.

Spiritus, . . 1 in 50. *Dose,* $\frac{1}{2}$ to 1 fluid drachm.

Also contained in *Linimentum Saponis* and *Tinctura Lavandulæ Composita* (5 minims in 1 pint).

SPIRITUS ROSMARINI—SPIRIT OF ROSEMARY.—*Take of oil of rosemary,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

Therapeutics.—Rosemary acts as an aromatic stimulant, carminative, and stomachic. The oil is sometimes added to liniments for the sake of its fragrance. The spirit is often added to hair washes.

Adulterations.—Inferior oils of lower specific gravity, and alcohol, oil of turpentine, and heavy petroleum oil.

Mentha arvensis—Corn-mint—(*not official*). *Botany.*—*Leaves*, stalked ovate or elliptical, serrate. *Calyx*, bell-shaped, with triangular teeth, which are as broad as long. *Flowering time*, July to September. *Habitat*, indigenous, cornfields. Its varieties, *piperascens* and *glabrata*, yield menthol.

Menthol—Menthol, $C_{10}H_{20}O$ or $C_{10}H_{19}OH$.—Mint Camphor—Mint Stearoptene.—A stearoptene [1] obtained by cooling the oil distilled from the fresh herb of *Mentha arvensis*, D.C., vars. *piperascens* et *glabrata;* and of *M. piperita*, Sm.

It is imported in large quantities from Japan.

[1] A Stearoptene is the solid oxygenated constituent of a volatile oil, usually held in solution at the ordinary temperature, but separating out on cooling to the freezing point.

Characters and Tests.—In colourless acicular crystals, usually more or less moist from adhering oil; or in fused crystalline masses. Its melting point should not exceed 110° F. (43·3° C.). The hardest masses do not melt below 108° F. (42·2° C.). It has the odour and flavour of peppermint, producing warmth on the tongue, or, if air is inhaled, a sensation of coolness.[1] It is sparingly soluble in water, and readily soluble in rectified spirit,[2] the solutions having a neutral reaction.[3] Boiled with sulphuric acid diluted with half its volume of water, menthol acquires an indigo-blue or ultramarine colour,[4] the acid becoming brown. It should entirely be dissipated by the heat of a water-bath.[5]

Dose.—$\frac{1}{2}$ to 2 grains.

[1] This is due to rapid evaporation of menthol and the production of partial anæsthesia, or possibly to a special action on the sensory nerves. [2] It is soluble in 1 in 4 of olive oil, and in much less than half its own weight of rectified spirit, benzol, chloroform, and ether. [3] Absence of impurities. [4] Menthylic sulphate, $(C_{10}H_{19})_2SO_4$, is formed. [5] Absence of inorganic impurities.

Menthol, or Menthylic Alcohol, is a monohydric alcohol of the allylic series, and when heated with hydrochloric acid or phosphorus pentachloride is converted into *Menthylic Chloride*, $C_{10}H_{19}Cl$. It forms corresponding compounds with bromine and iodine, and with all acids it forms compound ethers. It turns a ray of light to the left. Sodium acts on it energetically with evolution of hydrogen. When distilled with zinc chloride it yields *Menthene*, $C_{10}H_{18}$.

Official Preparation.

Emplastrum, ... 1 in 10.

EMPLASTRUM MENTHOL — Menthol Plaster. — *Take of menthol*, 2 *ounces; yellow wax*, 1 *ounce; resin*, 7 *ounces. Melt the wax and resin together, and, as the mixture cools, stir in the menthol until dissolved.*

Therapeutics.—When taken internally in small doses, menthol has the stimulant, aromatic, and carminative properties characteristic of essential oils; in larger doses it causes depression of the central nervous system, with symptoms of intoxication, culminating in stupor if the dose be very large. It is excreted in the urine. Locally applied, it acts as an anæsthetic by paralysing the ends of sensory nerves, and it is also irritating and rubefacient. It has an antiseptic and deodorant action. Menthol is successfully used locally in pain due to rheumatism, sciatica, lumbago, and neuralgia; in prurigo, applied as a solid cone, as plaster, or as a solution in alcohol or olive oil (30 grains to the ounce). As a snuff (mixed with boric acid, or subnitrate of bismuth, or gum-acacia, 10 grains or more to the ounce), it is employed in hay fever, coryza, and ozœna; or, dissolved in oil or in some of the colourless paraffin oils, may be used as a spray in the same conditions. In phthisis pulmonalis or laryngea its use as an intratracheal injection (10 to 20 per cent. in olive oil) has been followed by considerable relief of symptoms, partly from its anæsthetic and partly from its germicidal action.

Rubbed up with equal parts of phenol, or of chloral hydrate, or with two-thirds of camphor, it forms an oily liquid, which is irritating, and may be used as a counter-irritant painted on chronically-inflamed joints, &c. These mixtures are good local anæsthetics, and, applied on cotton-wool, relieve the pain of carious teeth.

Adulterations or Substitutions.—Wax is often present in menthol sold in the form of cones, and it may be detected by its insolubility in rectified spirit. Magnesium sulphate is sometimes present in the crystals. It may be detected by the insolubility in spirit and not being dissipated when heated on a water-bath, or it may be dissolved out by water and appropriate chemical tests applied. Glass has been found as an adulterant; it is left behind on dissipation by heat.

Thymus vulgaris—Garden Thyme—Thyme—(*not official*).

Botany.—A small, erect, woody shrub, annual, 8 to 10 inches high. *Stem*, thin, woody. *Leaves*, sessile, linear-lanceolate or ovate-lanceolate. *Flowers*, on terminal heads, small, purple. *Odour*, fragrant. *Taste*, aromatic. *Habitat*, Portugal, Italy, France, Spain ; cultivated in England. It yields Thymol.

Closely allied to the above is the Wild Thyme, *T. Serpyllum*, Sm., native to Britain, with leaves nearly glabrous and a procumbent woody stem, and found on dry heaths. It flowers from July to August—(*not official*). *Monarda punctata*, Linn.—Horse-mint.—Is a native of the United States. It is a perennial herb, growing on sandy fields, flowering from June till September. It has lanceolate leaves. Its flowers are yellowish, and form cymes. Like the foregoing, it yields Thymol.

Thymol—Thymol, $C_{10}H_{13}OH$.—A stearoptene obtained from the volatile oils of *Thymus vulgaris*, Linn.; *Monarda punctata*, Linn.; and *Carum Ajowan*, Benth. and Hook (*Ptychotis Ajowan*, D.C.), by saponifying with caustic soda, and treating the separated soap with hydrochloric acid, or from a distilled fraction of the oil by exposure to a low temperature.[1] It may be purified by recrystallisation from alcohol.

Characters and Tests.—Large oblique prismatic crystals, having the odour of thyme, and a pungent aromatic flavour. They sink in cold water, but on heating the mixture to a temperature of 110° to 125° F. (43·3° to 51·7° C.) they melt and rise to the surface. Slightly soluble in cold water, freely soluble in alcohol, ether, and solutions of alkalis.[2] The crystals volatilise completely at the temperature of a water-bath.[3] A solution of thymol in half its bulk of glacial acetic acid, warmed with an equal volume of sulphuric acid, assumes a reddish-violet colour.[4]

Dose.—$\frac{1}{2}$ to 2 grains.

[1] The fluid portion is thymene, $C_{10}H_{16}$. [2] It is soluble 1 in 1200 of water ; 1 in 190 of glycerine ; 1 in 2 of olive oil ; 1 in 6 of caustic potash solution, and in less than its own weight of rectified spirit and chloroform. [3] Absence of impurities, especially inorganic. [4] Said to be sensitive to a millionth part. Sulphothymolic acid is formed ($C_{10}H_{14}SO_4$).

Thymol is *methyl-propyl-phenol*. It is the phenol of cymene, ($C_{10}H_{14}$), and has been prepared synthetically from cuminol. It exists in the volatile oil along with the hydrocarbons *Cymene* and *Thymene*.

Therapeutics.—Thymol is closely allied in action to phenol, being antiseptic, deodorant, and locally anæsthetic. Internally it has been used as an intestinal antiseptic in typhoid fever, diarrhœa, and other putrefactive conditions. As an anthelmintic it has also proved valuable in larger doses (up to 15 grains), stupefying or killing the worms. It has been used instead of phenol as a surgical lotion (1 to 1000), as an antiparasitic and stimulant application in skin diseases (5 to 10 per cent. ointment), and in numerous other conditions in which carbolic acid is successfully employed. It has not succeeded in displacing the latter from general use.

Adulterations.—Sometimes phenol or inorganic impurities.

Mentha Pulegium, Linn.—Pennyroyal—(*not official*).

Botany.—A small *perennial*, indigenous. *Stem*, decumbent, branching, about 6 inches high. *Leaves*, 1 inch long, petiolate ovate, blunt, crenate at the margin, and dotted over with oil-glands. *Flowers*, in globose whorls, purplish in colour. *Flowering time*, August and September. *Odour*, fragrant. *Taste*, aromatic. The most important constituent is the *essential oil* distilled from the whole herb, the dose of which is 1 to 4 minims, and of the dried herb 2 to 4 ounces of a 1 in 20 infusion. It is used in domestic medicine as an antispasmodic and carminative, and it has some reputation as an emmenagogue and abortifacient.

Origanum vulgare, Linn.—Marjoram—Organy—(*not official*).—*Habitat*, indigenous; not common in Scotland.

Botany.—*Perennial.* Creeping root-stock. *Stem*, 1 to 3 feet high, quadrangular, pubescent, erect, stiff. *Leaves*, opposite, ovate, or rhombic-ovate, pubescent. *Flowers* form corymbose pannicles, purplish-pink. *Odour*, agreeable, aromatic. *Taste*, bitter, aromatic. *Flowering time*, August till October. The whole herb is employed. It contains *volatile oil*, *tannin*, and a *bitter principle.* The oil is rare, and what is usually sold as Oil of Marjoram is really Oil of Thyme. It is never used in regular practice, but as a domestic carminative and aromatic, diaphoretic, and emmenagogue it was formerly held in considerable reputation.

Marrubium vulgare, Linn.—Horehound—White Horehound—(*not official*).—*Habitat*, doubtful if indigenous.

Botany.—Perennial herb, with a short root-stock. *Stem*, 1 foot high, quadrangular, covered with a cottony felt. *Leaves*, opposite, woolly, petiolate, ovate, blunt or acute, crenate-serrate, silvery green and downy above, cottony beneath. *Flowers*, small, sessile, forming dense whorls, and whitish in colour. *Odour*, agreeable, aromatic. *Taste*, bitter, very penetrating. *Flowering time*, September. The whole herb is used, and it contains *volatile oil*, *resin*, *tannin*, and *bitter principle.* It is chiefly employed in domestic medicine as a tonic, aromatic, and expectorant, the dose being 2 to 4 fluid ounces of a 1 in 20 infusion. Candy and syrup of horehound are favourite preparations.

Salvia officinalis, Linn.—Sage—Garden Sage—(*not official*).—*Habitat.*—France, Spain; greatly cultivated in gardens, and at Mitcham in Surrey. The leaves are tonic and astringent, and contain *volatile oil*, *tannin*, and a *bitter principle*. Their chief use in this country is as a culinary flavouring agent. In some places the leaves were formerly substituted for tea.

Nat. Ord. **CHENOPODIACEÆ**—The Goosefoot Order.—Herbs or under-shrubs, very widely distributed.

Chenopodium—Chenopodium—American Wormseed.—The fruit of *Chenopodium ambrosioides*, var. *anthelminticum*, Gray—(*not official*).—*Habitat*, the United States. A volatile oil is distilled from the fruit, both being official in the U.S.P. The fruit in 10 to 40 grain doses is given as powder or electuary, the oil in 10 to 15 minim doses to expel lumbricoid worms.

SUB-CLASS IV.—MONOCHLAMYDEÆ—INCOMPLETÆ—APETALÆ.

Nat. Ord. **POLYGONACEÆ**—The Buckwheat Order.—Herbs, rarely shrubs, generally distributed both in cold and warm climates. The plants possess astringent and purgative properties.

Official Plants.

Botanical Name.	Part Used.	Habitat.
RHEUM PALMATUM. " OFFICINALE and other species.	Root.	China and Thibet.

Rheum palmatum—Rhubarb—Kiachta Rhubarb.

Rheum officinale—Thibetan Rhubarb.

RHEI RADIX—*Rhubarb Root.*—The root, more or less deprived of its bark, sliced and dried, of *Rheum palmatum*, Linn.; *Rheum officinale*, Baillon; and probably other species. Collected and prepared in China and Thibet.

Collection, &c.—Rhubarb root from *Rheum palmatum* is obtained chiefly from wild plants growing in the province of Kansu. The Chinese and Tangutans dig up the root in September and October, cut off the lateral offshoots, remove the outer rind, and then divide the root into pieces, which are hung up to dry, either in the house at ordinary temperature, or by artificial heat. Rhubarb finds its way to Hankow,[1] and from that city is purchased for European markets. The finest is known as Turkey or Russian rhubarb,[2] and is probably the product of *Rheum palmatum.*

Of *Rheum officinale* little is known. It is said to grow wild in Thibet, near the Chinese boundary. The plant has been grown at Kew Gardens, Banbury, and Paris, and it is perhaps the source of a small proportion of the root used in medicine, but most is obtained from *R. palmatum.*

[1] From Hankow it is sent to Shanghai, Canton or Amoy, and then shipped to London chiefly. [2] Formerly rhubarb which was brought by caravans to the Levant, and was shipped to Europe, was known as Turkey rhubarb, but when this source of supply was stopped, rhubarb brought from Canton by way of Russia took its place, and was known as Russian or Turkey rhubarb. It, like the former, was of good quality, hence the names are now loosely applied to rhubarbs of good quality. This source of supply has also ceased. Rhubarb which was shipped direct from China or came by way of India was known as China, Canton, or East Indian Rhubarb.

Characters.—In somewhat cylindrical, barrel-shaped, conical, plano-convex, or irregularly formed pieces ; the outer surface covered with a bright yellowish-brown powder, rounded or somewhat angular, smooth or more or less wrinkled, and marked beneath the powder with reddish-brown or dark rusty-brown lines, intermixed in a yellowish-brown substance, and frequently presenting small scattered starlike spots.[1] Frequently the pieces are bored with a hole, which contains the remains of the cord used to suspend them to dry, or the cord has been removed. Hard, compact, fracture uneven, presenting a marbled appearance, and in some cases exhibiting a ring of starlike spots.[1] Odour peculiar and somewhat aromatic ; taste bitter, feebly astringent, and when chewed it feels gritty between the teeth.[2]

[1] These spots were at one time thought to be peculiar to Chinese or Thibetan rhubarb, but they have also been seen in European rhubarb, although they are often wanting in the latter. [2] Due to calcium oxalate crystals.

Dose.—5 to 20 grains as purgative ; 1 to 3 grains as stomachic.

Active Principles.—Rhubarb contains *Chrysophan*, $C_{27}H_{30}O_{14}$, a glucoside, orange-yellow in colour, bitter, and soluble in water and in alcohol. *Chrysophanic Acid* is also present in considerable amount. It is a decomposition product of chrysophan, from which it may be formed by boiling with dilute acids. Its formula is $C_{15}H_{10}O_4$, and it occurs in tasteless, bright-yellow crystals, nearly insoluble in cold water, somewhat soluble in alcohol and ether, freely in chloroform, benzol, fixed and volatile oils. Four resins, *Erythroretin*, *Emodin*, *Phæoretin*, and *Aporetin* are also present. *Rheotannic Acid*, $C_{26}H_{26}O_{14}$, soluble in water and alcohol, is also an important constituent; *oxalate of calcium crystals* impart the characteristic gritty feeling in the mouth. Starch and other ordinary constituents of roots are present also.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	No. 40 powder.	... ...	5 to 15 grains.
Infusum.	Thin slices.	1 in 40.	1 to 2 fluid ounces.
Pilula Composita.	Fine powder.	1 in 4 (about).	5 to 10 grains.
Pulvis Compositus.	,, ,,	1 in $4\frac{1}{2}$.	20 to 60 grains.
Syrupus.	No. 20 powder.	1 in 15 (about).	1 to 4 fluid drachms.
Tinctura.	,, ,, ,,	1 in 10.	1 to 2 fluid drachms stomachic. $\frac{1}{2}$ to 1 fluid ounce purgative.
Vinum.	Coarse powder.	1 in 15.	1 to 2 fluid drachms.

EXTRACTUM RHEI—Extract of Rhubarb.—*Take of rhubarb root, in No.* 40 *powder*, 1 *pound; proof spirit and distilled water, of each a sufficiency. Macerate in* 3 *pints of spirit, and then percolate with water till* 5 *pints of fluid have been collected, after which evaporate by water-bath to pilular consistence.*

INFUSUM RHEI—Infusion of Rhubarb.—*Take of rhubarb root, in thin slices*, $\frac{1}{4}$ *ounce; boiling distilled water*, 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

PILULA RHEI COMPOSITA—Compound Rhubarb Pill.—*Take of rhubarb root, in powder*, 3 *ounces; socotrine aloes, in powder*, $2\frac{1}{4}$ *ounces; myrrh, in powder, hard soap, in powder, of each* $1\frac{1}{2}$ *ounce; oil of peppermint*, $1\frac{1}{2}$ *fluid drachm; glycerine*, 1 *ounce; treacle, about* 3 *ounces. Mix the powders with the oil, then add the glycerine and sufficient treacle, and beat the whole into a uniform mass.*

PULVIS RHEI COMPOSITUS — COMPOUND POWDER OF RHUBARB—Gregory's Powder.—*Take of rhubarb root, in powder,* 2 *ounces; light magnesia* (*or heavy magnesia*), 6 *ounces; ginger, in powder,* 1 *ounce. Mix them thoroughly, and pass the powder through a fine sieve.*

SYRUPUS RHEI—SYRUP OF RHUBARB.—*Take of rhubarb root, in No.* 20 *powder, coriander fruit, in No.* 20 *powder, of each* 2 *ounces; refined sugar,* 24 *ounces; rectified spirit,* 8 *fluid ounces; distilled water,* 24 *fluid ounces. Mix the rhubarb and coriander; pack them in a percolator; pass the spirit and water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to* 14 *fluid ounces, and in this, after it has been filtered, dissolve the sugar with a gentle heat. The product should weigh nearly* 2½ *pounds, and have a specific gravity of about* 1·310.

This preparation does not keep well in summer; it is apt to ferment—a difficulty which could be obviated by adding a small quantity of glycerine. (See the Elixir, B.P.C.)

TINCTURA RHEI—TINCTURE OF RHUBARB.—*Take of rhubarb root, in No.* 20 *powder,* 2 *ounces; cardamom seeds, freed from the pericarps and bruised, coriander fruit, bruised, saffron, of each* ¼ *ounce; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

VINUM RHEI—WINE OF RHUBARB.—*Take of rhubarb root, in coarse powder,* 1½ *ounce; canella bark, in coarse powder,* 60 *grains; sherry,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient sherry to make* 1 *pint.*

ELIXIR RHEI—ELIXIR OF RHUBARB, B.P.C.—(*not official*).—*Take of rhubarb root, in No.* 12 *powder,* 5 *ounces; fennel fruit, bruised,* 2 *ounces; glycerine,* 3 *fluid ounces; refined sugar,* 4 *ounces; rectified spirit,* 1 *volume, distilled water,* 3 *volumes, of each a sufficient quantity. Moisten the rhubarb and fennel with* 15 *fluid ounces of the mixed spirit and water, macerate for forty-eight hours, and express. Break up the marc and add sufficient of the same menstruum to make, with the previous pressing,* 15 *fluid ounces of clear product. Express again after twenty-four hours' maceration. Unite the liquors, allow to stand for two days,*[1] *and filter into the sugar and glycerine. Dissolve without heat, then, if necessary, add sufficient menstruum to make* 1 *pint.*

Dose.—1 to 3 fluid drachms.

[1] By this means albuminous substances likely to cause fermentation are precipitated by the prolonged contact with the spirit and are removed by filtration.

Therapeutics.—Rhubarb acts as a stomachic tonic, astringent, and purgative. In small doses it is a tonic, improving the appetite and digestion, and for this purpose enters into the composition of many *dinner pills.* In larger doses it is purgative, acting by increasing the peristaltic movement of the bowels throughout their entire extent, but especially in the duodenum, rather than by increasing the secretions of the alimentary canal. Rhubarb acts secondarily as an astringent, in virtue of the tannin contained in it, causing constipation after its purgative effects have passed off. The colouring matter of rhubarb is taken into the circulation and passes out by the urine, which, if acid, is yellow in colour, but if alkaline, assumes a red hue. Rhubarb is an excellent purgative for children when there is much irritation of the alimentary canal, for it first eliminates irritating matters, and then by its astringency prevents subsequent diarrhœa, and when combined with grey powder is very useful in treating some forms of diarrhœa in children. For adults, this tendency to cause constipation may render it objectionable as an ordinary laxative, but the constipation is never severe, and is useful in diarrhœa, dysentery, &c., while rhubarb may be combined with other drugs, as in the compound pill and powder, so as to answer a variety of purposes. It is an extremely useful purgative for convalescents and delicate people generally. Its tendency to gripe is not great, and in the official preparations is to a large extent removed by the addition of carminatives.

Adulterations or Substitutions.—The tests given for rhubarb are that it should not be worm-eaten and that boric acid should not turn the yellow exterior of the root brown, thus showing an absence of turmeric, but this substance is more likely to be found in powdered rhubarb, and for its detection the following test has been proposed. Put a grain or two of the powder on blotting-paper and pass a few drops of chloroform over it, and on the stain so produced put a pinch of powdered borax and one drop strong hydrochloric acid, when, if turmeric be present, the colour, which was formerly brown, will at once change to a distinct red.

English rhubarb is chiefly exported in the form of powder. When trimmed it is not unlike the Chinese variety. The pieces are semicylindrical, with an odour differing from the Chinese drug, and the taste is not nearly so bitter, but is more astringent and mucilaginous. Its structure is more spongy, softer and more brittle, and the star-like spots mentioned in the characters of the official drug are either absent or are not regularly arranged. Its analysis shows it to contain a great excess of *starch* and a small proportion of *calcium oxalate.* It is the product of *R. Rhaponticum*, Linn. The common Garden Rhubarb is *R. undulatum* (*Rhabarbarum*, Linn.), and is cultivated chiefly for its acid leaf-stalks, used in making tarts, &c.

Formerly *R. Rhaponticum*, *R. palmatum*, *R. undulatum*, and *R. compactum* were cultivated in France, Germany, and Austria for the sake of the root, which received the names of the countries in which they were grown, but they have now passed out of commerce.

Nat. Ord. **LAURACEÆ**—The Laurel Order.—Trees, inhabiting tropical regions. The plants are aromatic and fragrant, yielding fixed and volatile oils, and camphor.

Official Plants.

Name.	Parts Used.	Habitat.
Cinnamomum Camphora.	Stearoptene.	China and Japan.
Cinnamomum zeylanicum.	Inner bark of shoots.	Ceylon.
Sassafras officinalis.	Dried root.	North America.
Nectandra Rodiæi.	Dried bark.	British Guiana.

Cinnamomum Camphora—The Camphor Tree.—Camphor Laurel.

Camphora—*Camphor.*—A stearoptene obtained from the wood of *Cinnamomum Camphora*, Nees and Eberm. (*Camphora officinarum*, Nees; *Laurus Camphora*, Linn.). Imported in the crude state, and purified by sublimation.

Preparation.—Camphor, or laurel camphor as it is sometimes called, is obtained from the island of Formosa (*China or Formosa Camphor*) and from Japan (*Japan or Dutch Camphor*). The tree is about 30 feet high, and the camphor is found deposited in minute pieces in the interstices of the wood. The wood is broken up into small chips, which are placed over, or in, vessels filled with water, and strongly heated. The steam carries off the camphor which is condensed in earthenware pots placed over the chips. The crude product is in greyish-white, brownish or pinkish crystalline grains, which cohere in masses of varying size and shape. It contains from 2 to 10 per cent. of impurities, and is purified in this country by resublimation, after being mixed with a small quantity of lime, which removes resin, volatile oil, and moisture.

Chemistry.—The camphor tree contains a large quantity of *volatile oil of camphor*, which consists of various terpenes, and oxidised products of these. *Camphor*, $C_{10}H_{16}O$, is derived from a terpene by oxidation, and is gradually deposited in the wood of the tree. The volatile oil generally holds in solution a good deal of camphor, which may be separated out by cooling.

Characters.—In solid colourless translucent crystalline masses, usually fissured; somewhat tough, but readily powdered if moistened with rectified spirit, ether, or chloroform; it has a powerful penetrating odour, and a pungent somewhat bitter taste, followed by a feeling of cold. It floats on water, burns with a smoky flame, volatilises even at ordinary temperatures, and sublimes entirely when heated; very slightly soluble[1] in water, readily soluble in rectified spirit, ether, or chloroform.

Dose.—1 to 10 grains.

[1] Squire gives the solubilities as 1 in 700 of water; 1 in $1\frac{1}{4}$ rectified spirit; 4 in 1 chloroform; 12 in 7 ether; 1 in 4 olive oil; 1 in $1\frac{1}{2}$ oil of turpentine.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Camphor.	Saturated solution.	1 to 2 fluid ounces.
Linimentum.	"	1 in 5 nearly.	...
Linimentum Compositum.	"	1 in 9 about.	...
Spiritus.	"	1 in 10.	10 to 30 minims.
Tinctura Composita.	"	$1\frac{1}{2}$ grain in 1 fluid ounce.	15 to 60 minims.

Camphor is also contained in *Linimentum Aconiti* (1 in 30)—*Belladonnæ* (1 in 30)—*Chloroformi* (1 in 10)—*Hydrargyri* (1 in 15)—*Opii* (1 in 10 nearly)—*Saponis* (1 in 21)—*Sinapis Compositum* (1 in 16)—*Terebinthinæ* (1 in 20)—*Terebinthinæ Aceticum* (1 in 11); *Unguentum Hydrargyri Compositum* (1 in 9).

AQUA CAMPHORÆ—Camphor Water.—Mistura Camphoræ.—*Take of camphor, crushed, $\frac{1}{2}$ ounce; distilled water,* 1 *gallon. Enclose the camphor in a muslin bag, and attach this to a piece of glass, by means of which it may be kept at the bottom of a bottle containing the* *distilled water. Close the mouth of the bottle, macerate for at least two days, and then pour off the solution when it is required.*

Camphor water is used in making *Injectio Apomorphinæ Hypodermica*, *Injectio Ergotini Hypodermica*, and *Liquor Atropinæ Sulphatis*, to act as a preservative.

LINIMENTUM CAMPHORÆ—LINIMENT OF CAMPHOR.—*Take of camphor*, 1 *ounce; olive oil*, 4 *fluid ounces. Dissolve the camphor in the oil.*

It is used in preparing *Linimentum Chloroformi* (1 in 2), *Linimentum Hydrargyri* (1 in 3), and *Linimentum Terebinthinæ Aceticum* (4 in 9).

LINIMENTUM CAMPHORÆ COMPOSITUM—COMPOUND LINIMENT OF CAMPHOR.—*Take of camphor*, $2\frac{1}{2}$ *ounces; oil of lavender*, 1 *fluid drachm; strong solution of ammonia*, 5 *fluid ounces; rectified spirit*, 15 *fluid ounces. Dissolve the camphor and oil of lavender in the spirit; then add the solution of ammonia gradually, shaking them together until a clear solution is formed.*

SPIRITUS CAMPHORÆ—SPIRIT OF CAMPHOR.—*Take of camphor*, 1 *ounce; rectified spirit*, 9 *fluid ounces. Dissolve.*

TINCTURA CAMPHORÆ COMPOSITA—COMPOUND TINCTURE OF CAMPHOR.—*Take of opium, in powder, benzoic acid, of each* 40 *grains; camphor*, 30 *grains; oil of anise*, $\frac{1}{2}$ *fluid drachm; proof spirit*, 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient proof spirit to make* 1 *pint.*

It contains the soluble matter of $\frac{1}{4}$ grain opium in 1 fluid drachm.

CAMPHORA MONOBROMATA.—Monobromide of Camphor, $C_{10}H_{15}BrO$—(*not official*).—It occurs in colourless crystals with a camphoraceous odour and taste; almost insoluble in water, soluble in rectified spirit and ether.

Dose.—2 to 10 grains.

SPIRITUS CAMPHORÆ FORTIOR.—Rubini's Solution of Camphor, Rubini's Essence—(*not official*).—A solution of camphor (1 ounce) in absolute alcohol (1 ounce by weight); nearly 1 grain camphor in 2 minims.

Dose.—2 to 5 minims, repeated if necessary.

Therapeutics.—In the stomach camphor has a carminative action; after absorption in small doses (grains ii–v–x.) it acts as a stimulant, increases the action of the heart, exhilarates the spirits, excites the cutaneous circulation, and causes diaphoresis. The pulse is slower, softer, and fuller. In doses somewhat larger, it is antispasmodic, anodyne, and hypnotic. In large doses, it is a narcotic poison, producing stupor or delirium, vertigo, and convulsions by its action on the nervous system. It also acts slightly upon the genito-urinary system as a sedative.

Therapeutically, camphor is employed as a cardiac stimulant, as a nervine sedative, anodyne, antispasmodic, diaphoretic, and anaphrodisiac. As a *stimulant*, in typhus and typhoid fevers, and in low febrile conditions generally; in asthenic inflammations and similar depressed conditions. As a *sedative*, in delirium tremens, associated with great exhaustion, in insanity, in puerperal mania, in chordee, in cases of poisoning from irritant substances, which act specifically upon the genito-urinary organs, such as cantharides. As an *antispasmodic*, it is administered in asthma, emphysema, and in chronic coughs generally, and in hysteria. As an *anodyne*, it is applied externally in neuralgic headache, in painful burning skin eruptions, in chronic eczema and prurigo; in pruritus, in toothache, in myalgic, neuralgic, and rheumatic pains. As a *diaphoretic*, it is not very active, but is a useful adjunct to other diaphoretics. As an *anaphrodisiac*, it is given in nymphomania and spermatorrhœa, as it exerts an undoubtedly sedative effect upon the genital organs when administered in large doses. It is also useful alone or combined with tincture of opium (the Spirit or Rubini's essence) in summer diarrhœa, where its stimulant and antiseptic actions probably come into play. In hay fever or irritable conditions of the nasal mucous membrane, it may be used as a snuff.

Volatile Oil of Camphor is used largely in China, and to some extent in Europe, as a local anodyne and stimulant application.

Borneo Camphor is obtained from the *Dryobalanops Camphora*, Colebrooke (*nat. ord.* Dipteraceæ). It is known also as Sumatra, Malay, and Baros Camphor, or to chemists as Borneol, has the formula $C_{10}H_{18}O$, and occurs in large, flat, white crystals, dextrogyre and slightly heavier than water, which are picked out of the split wood by hand. It is much esteemed in China, where it fetches a very high price, but its properties and actions are practically identical with those of laurel camphor.

Ngai Camphor, a product of *Blumea balsamifera*, D.C. (*nat. ord.* Compositæ), is isomeric with Borneol, but is levogyre. It is intermediate in price between the other two, and is all consumed in China, partly as a medicine and partly as a perfume.

Cinnamomum zeylanicum—The Cinnamon Tree.

CINNAMOMI CORTEX—*Cinnamon Bark.*—The dried inner bark of shoots from the truncated stocks or stools of the cultivated cinnamon tree, *Cinnamomum zeylanicum*, Breyn. Imported from Ceylon, and distinguished in commerce as Ceylon Cinnamon.

Cultivation, &c.—The best variety is cultivated on the south-west coast of Ceylon. The plant is cut short, and from the trunk four or five shoots are allowed to grow. These are cut when about two years old, and are then 6 or 10 feet high, and about ½ to 2 inches thick. The bark is removed from them in pieces about a foot long, made up into quills, which are put one within another, and bound into bundles. These bundles are left for a short time, when the outer and middle cortical layers are more easily removed. The inner layers are placed one within another again, dried in the sun, and made up finally into bundles.

Characters and Tests.—In closely-rolled quills, each about ⅜ inch in diameter, and containing several smaller quills. It is thin, brittle, splintery, moderately pliable, dull light yellowish-brown externally, and marked by little scars or holes [1] and faint, shining, wavy lines; darker on its inner surface. Odour fragrant; taste warm, sweet, and aromatic. A decoction when cool is not coloured by iodine.[2]

[1] Where leaves or twigs have sprung from. [2] Absence of starch.

Dose.—10 to 20 grains.

Active Principles.—*Volatile oil* (about ½ to 1½ per cent.) is the chief constituent. *Tannin*, *sugar*, *starch*, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aqua.	Bark bruised.	...	½ to 2 fluid ounces.
Oleum.	,, ,,	...	1 to 4 minims.
Pulvis Compositus.	,, in powder.	1 in 3.	3 to 10 grains.
Spiritus.	Oil.	1 in 50.	⅕ to 1 fluid drachm.
Tinctura.	Bark, coarse powder.	1 in 8.	½ to 2 fluid drachms.

Also contained in *Decoctum Hæmatoxyli* (1 in 160 nearly); *Infusum Catechu* (1 in 160); *Pulvis Catechu Compositus* (1 in 10)—*Cretæ Aro-*

maticus (1 in 12)—*Cretæ Aromaticus cum Opio* (1 in 12 nearly)—*Kino Compositus* (1 in 5); *Tinctura Cardamomi Composita* (1 in 40)—*Catechu* (1 in 20)—*Lavandulæ Composita* (1 in 16); *Vinum Opii* (1 in 16).

AQUA CINNAMOMI—CINNAMON WATER.—*Take of cinnamon, bruised*, 20 *ounces; water*, 2 *gallons. Distil* 1 *gallon.*

Cinnamon water is contained in *Mistura Cretæ,—Guaiaci*, and *Spiritus Vini Gallici* as a flavouring agent.

OLEUM CINNAMOMI—Oil of Cinnamon.—The oil distilled from cinnamon bark.

Characters.—Yellowish when recent, but gradually becoming cherry-red, having the odour and taste of cinnamon bark. Sinks in water.

Chemistry.—Its specific gravity varies from 1035 to 1065. It is very soluble in alcohol, slightly in water, and consists chiefly of *Cinnamic Aldehyde* (75 to 90 per cent.), C_9H_8O, which in old specimens oxidises partly to *Cinnamic Acid*, $C_9H_8O_2$. *Cinnamyl Acetate* and *hydrocarbons* are also present.

SPIRITUS CINNAMOMI—Spirit of Cinnamon.—*Take of oil of cinnamon*, 1 *fluid ounce; rectified spirit*, 49 *fluid ounces. Dissolve.*

It is contained in *Acidum Sulphuricum Aromaticum* (1 in 2½).

PULVIS CINNAMOMI COMPOSITUS—COMPOUND POWDER OF CINNAMON—*Syn.* Pulvis Aromaticus.—*Take of cinnamon bark, in powder; cardamom seeds, in powder; ginger, in powder, of each* 1 *ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.*

It is contained in *Pilula Aloes et Ferri* (1 in 3½) and *Pilula Cambogiæ Composita* (1 in 6 nearly).

TINCTURA CINNAMOMI—TINCTURE OF CINNAMON.—*Take of cinnamon bark, in coarse powder*, 2½ *ounces; rectified spirit*, 1 *pint. Made by maceration and percolation.*

Therapeutics.—Cinnamon acts as a stimulant, carminative, and antispasmodic. It is largely used as a flavouring agent, and is present in numerous pharmacopœial preparations which are given as astringents and purgatives, where its carminative and antiseptic actions are valuable. As a spice it is used in cookery.

Adulterations.—Cassia bark is the chief.

Cinnamomum Cassia—Cassia—Chinese Cinnamon—(*not official*).—*Habitat*, China and Java. In the U.S.P. the bark and volatile oil are official. The former is known as *Cassia Bark* and *Cassia lignea*, and is not so carefully prepared as Ceylon cinnamon. It occurs in yellowish-brown quills, nearly deprived of the corky layer; odour and taste like those of cinnamon, but less delicate. It contains *volatile oil*, about 1 to $1\frac{1}{2}$ per cent. (*Oleum Cinnamomi Cassiæ*), *tannin*, *sugar*, *mannite*, *mucilage*, *starch*, &c. Its properties and uses are those of Ceylon cinnamon.

Sassafras officinale—Sassafras Tree.

SASSAFRAS RADIX—*Sassafras Root.*—The dried root reduced to chips or shavings of *Sassafras officinale*, Nees (*Laurus Sassafras*, Linn.).

Characters.—In large branched pieces, more or less covered with bark; bark rough, externally greyish-brown or rusty-brown, internally smooth, glistening, and rusty-brown, of an agreeable odour, and a peculiar aromatic, somewhat astringent, taste; wood light, porous, greyish-yellow, more feeble in odour and taste than the bark.

Active Principles.—The wood of sassafras root yields about 1 to 2 per cent. of *volatile oil.* The oil varies in tint from colourless to reddish-brown, and deposits on being cooled *Safrol* or *Sassafras Camphor*, $C_{10}H_{10}O_2$; *Safrene*, $C_{10}H_{16}$, is also present, and other bodies in small amount. The root bark yields about twice as much oil as the wood, and is official in the U.S.P.

Contained in *Decoctum Sarsæ Composition* (1 in 80).

Therapeutics.—The oil is an aromatic stimulant like other volatile oils, and has a slight diaphoretic action. Neither it nor the root are much used in this country. It has had alterative properties attributed to it, and was formerly often given in syphilis, chronic rheumatism, and skin diseases along with sarsaparilla and guaiac. In America it still retains considerable reputation, especially as a domestic remedy.

Nectandra Rodiæi—Greenheart—Brown Greenheart.—Bebeeru—Bibiru—Sipiri.

NECTANDRÆ CORTEX—*Bebeeru Bark.*—The dried bark of *Nectandra Rodiæi*, Schomb.

Characters.—In flat heavy pieces, from 1 to 2 feet long, 2 to 6 inches broad, and about $\frac{1}{4}$ inch thick. External colour greyish-brown, internal dark cinnamon-brown, and with longitudinal striæ.

Taste strongly and persistently bitter, with considerable astringency; no odour. It is very hard and brittle.

Active Principles.—An alkaloid, *Beberine,* identical with buxine and pelosine; *Nectandrine* and probably other alkaloids are also present.

Official Preparation.

Beberinæ Sulphas, . . *Dose,* 1 to 10 grains.

BEBERINÆ SULPHAS — Sulphate of Beberine.— Prepared from Nectandra or Bebeeru bark. It is probably a mixture of sulphates of beberine, $C_{36}H_{42}N_2O_6$, nectandrine, $C_{40}H_{46}N_2O_8$, and other alkaloids.

Preparation.—For numerous details, see B.P.—1. Thoroughly exhaust the powdered bark with diluted sulphuric acid.[1]

2. Concentrate the solution, and add milk of lime scarcely sufficient to neutralise the acid.[2]

3. Filter, and add liquor ammoniæ to filtrate until it has an ammoniacal odour.[3]

4. Collect precipitate, wash it with water, and purify with alcohol.

5. Add sulphuric acid to form the sulphate.

6. Evaporate at a low temperature.

[1] To extract the alkaloids as sulphates. [2] To precipitate excess of sulphuric acid, tannin, colouring matter, &c., leaving the alkaloidal salts in solution. [3] To precipitate beberine and other alkaloids.

Characters.—In dark-brown, thin, translucent scales, yellow when in powder, with a strong bitter taste, soluble in water and in alcohol. Its watery solution gives a white precipitate with chloride of barium; and with caustic soda a yellowish-white precipitate, which is dissolved by agitating the mixture with twice its volume of ether. The ethereal solution, separated by a pipette and evaporated, leaves a yellow translucent residue, entirely soluble in dilute acids. Ignited, it burns without residue.

Therapeutics.—In its native country the bark is employed as a tonic, antiperiodic and febrifuge. In this country the alkaloids have been used for the same purposes, but the results have been disappointing, and it is certainly very much inferior to quinine.

Laurus nobilis—(*not official*).—Bay—Sweet Bay—True Laurel.

Botany.—A small tree. *Leaves,* evergreen, alternate, 3 to 4 inches long, lanceolate, entire. *Flowers,* unisexual, diœcious, small, on smooth pedicles, arranged in umbellate stalked clusters. *Fruit*, succulent, ovoid, about $\frac{3}{4}$ inch long, smooth, purplish-black, pulp scanty. *Seed*, solitary and oily. *Habitat*, Mediterranean shores; cultivated in this country. *Flowering time*, spring. Fruit ripe in October and November.

The fruit and leaves contain a fragrant volatile oil, which gives them aromatic and stimulant properties. Formerly they were used in colic, hysteria, and similar affections, but not at the present day.

Oil of Bays is expressed from the seeds, and is a mixture of fat and volatile oil. It is buttery in consistence, greenish in colour, with a fragrant odour, and is sometimes applied to sprains, bruises, &c.

Coto Cortex — *Coto Bark.*—The bark of an unknown tree imported from Bolivia—(*not official*).—It probably belongs to the natural order *Lauraceæ.*

Characters.—In flat or curved pieces, about 1 foot in length and $\frac{3}{4}$ inch broad. Externally cinnamon-brown in colour, and when broken, appears studded with yellow spots. Odour, aromatic; taste, aromatic, biting, and slightly bitter. The powder causes sneezing.

Dose.—5 to 30 grains.

Chemistry.—It contains a glucoside, *Cotoin*, $C_{22}H_{18}O_6$, soluble in alcohol, slightly so in water, which gives a blood-red colour with nitric acid.

TINCTURA COTO—Tincture of Coto (*not official*), B.P.C.—*Take of coto bark, bruised,* 2 *ounces; rectified spirit,* 1 *pint. Macerate for seven days with occasional agitation; press, filter, and make up to* 1 *pint.*

Dose.—10 to 30 minims; of cotoin, $\frac{1}{2}$ to 2 grains.

Therapeutics.—Small doses taken internally increase appetite; large doses cause nausea and vomiting. It is antiseptic. Although it does not cause constipation in healthy individuals, it has proved remarkably useful in catarrhal diarrhœa, cholera infantum, tubercular diarrhœa, and in enteric fever. It is said also to check the night sweats of phthisis. It should be used with caution in acute cases, or where there is any tendency to intestinal hæmorrhage. It seems to act by dilating the blood-vessels of the gastro-intestinal mucous membrane, and thus promoting the activity and healthy action of the epithelial cells.

Paracoto Bark is probably derived from an allied species, and is difficult to distinguish from true coto. It contains a body, *Paracotoin*, similar in properties and action to cotoin, but said to be feebler. With nitric acid it gives a yellow colour.

Nat. Ord. **MYRISTICACEÆ**—The Nutmeg Order.—Tropical trees possessing acrid and aromatic properties.

Official Plant.

Name.	Part Used.	Habitat.
MYRISTICA FRAGRANS.	Dried seed.	East Indian Archipelago.

Myristica fragrans—The Nutmeg Tree.

MYRISTICA—*Nutmeg.*—The dried seed of *Myristica fragrans*, Houtt (*M. officinalis*, Linn.; *M. aromatica*, Lam.; *M. moschata*, Thunb.).

It is an evergreen tree, indigenous to the Moluccas and neighbouring islands, where it is cultivated, as well as in Mauritius, West Indies, and South America. The fruit is fleshy, about the size of a small apple, yellowish-white, and enclosing a single seed. The seed is enclosed in an irregularly formed fleshy arillus, bright red when fresh, yellow and brittle when dry; the dried arillus is the well-known spice called mace. Internal to it is a hard testa and thin inner seed-coat enclosing the kernel of the seed, which is nutmeg. The seeds, after removal of the mace, are very slowly dried for about two months by the heat of a fire, the shells are then cracked and the nutmeg removed.

Characters.—Oval or roundish, about an inch in length, greyish-brown externally, and marked with reticulated furrows; internally greyish-red, with darker brownish-red rims, giving a marbled appearance on section. Odour strong, pleasant and aromatic; taste aromatic, warm, and bitterish.

Chemistry.—Nutmegs contain a *volatile oil* (2 to 8 per cent.) and a *fixed oil* (25 to 30 per cent.), both of which are official. *Starch*, *albumin*, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Oleum.	Nutmeg.	...	...
Oleum Expressum.	"	...	...
Spiritus.	Volatile oil.	1 in 50.	½ to 1 fluid drachm.

Contained also in *Pulvis Catechu Compositus* (1 in 10)—*Cretæ Aromaticus* (1 in 16 nearly)—*Cretæ Aromaticus cum Opio* (1 in 16 nearly); *Spiritus Armoraciæ Compositus* (1 in 320); *Tinctura Lavandulæ Composita* (1 in 16).

OLEUM MYRISTICÆ—Volatile Oil of Nutmeg.—The oil distilled in Britain from nutmeg.

Characters.—Colourless or straw-yellow, having the odour and taste of nutmeg. It is dextrogyre, specific gravity 0·93, and consists of *Myristicene*, $C_{10}H_{16}$, and *Myristicol*, $C_{10}H_{14}O$.

Contained also in *Pilula Aloes Socotrinæ* (1 in 33) and *Spiritus Ammoniæ Aromaticus* (1 in 300 about).

SPIRITUS MYRISTICÆ—SPIRIT OF NUTMEG.—*Take of volatile oil of nutmeg*, 1 *fluid ounce; rectified spirit*, 49 *fluid ounces. Dissolve.*

OLEUM MYRISTICÆ EXPRESSUM—Expressed Oil of Nutmeg—*Syn.* Myristicæ Adeps.—A concrete oil obtained by expression and heat from nutmeg.

Characters.—Orange-brown or orange-yellow, more or less mottled, firm consistence, and fragrant odour, like that of nutmeg. It is used in making *Emplastrum Calefaciens* and *Emplastrum Picis.*

Therapeutics.—Nutmegs and mace are both used as stimulating and flavouring condiments or spices. Medicinally, the volatile oil and the spirit are used as carminative and flavouring adjuncts to other remedies, and they act of themselves as mild aromatic stimulants. Nutmeg is useful in diarrhœa. Externally they operate as topical stimulants, and the fixed oil has been thus used in chronic rheumatism and other local pains, alone or in the official plasters of which it forms an ingredient. In large doses the oil has narcotic properties, and cases have frequently occurred in which children have been seriously poisoned by eating nutmegs.

Nat. Ord. **THYMELACEÆ**—The Mezereon Order.—Shrubby plants, generally distributed. The plants possess acrid, irritant, and occasionally narcotic properties.

Official Plants.

Name.	Part Used.	Habitat.
DAPHNE MEZEREUM.	Dried bark.	Indigenous.
DAPHNE LAUREOLA.	...	...

Daphne Mezereum—Mezereon.
Daphne Laureola—Spurge Laurel.

Botany — D. Mezereum.—A small shrub. *Leaves*, lanceolate, smooth, evergreen, deciduous. *Flowers*, pale, rose-coloured. *Fruit*, bright-red, fleshy, one-seeded berry, about $\frac{3}{8}$ inch long. *Flowering time*, March; fruit ripe in July.

D. Laureola.—A small bushy shrub, 1 to 3 feet high. *Leaves*, smooth, leathery, evergreen, 3 to 5 inches long. *Flowers*, green, arranged in axillary racemes. *Fruit*, an oval, bluish-black berry. *Flowering time*, from January to April; fruit ripe in summer.

MEZEREI CORTEX—*Mezereon Bark.*—The dried bark of *Daphne Mezereum*, Linn. (*Mezereum officinarum*, C. A. Meyer); or of *D. Laureola*, Linn.

Characters.—In long, thin, more or less flattened strips, which are commonly folded or rolled into discs; or in small quills of various lengths. Inner surface whitish, silky, very tough, and covered externally by an olive-brown or somewhat reddish-brown, readily separable corky layer. No marked odour; taste burning and acrid. It should be collected in the winter months.

The root-bark is more powerful than the stem-bark, but they are used indiscriminately, as it is difficult to obtain a sufficient supply of the former. The stem-bark may be distinguished, especially when fresh, by the green colour of the part beneath the outer corky layer. The bark of the younger branches of *D. Mezereum* are marked by leaf-scars, which are absent in *D. Laureola*.

Chemistry.—There is an acrid *resin* and an acrid *volatile oil* which have not been thoroughly examined. A crystalline glucoside, *Daphnin*, has been described also, but it seems destitute of active properties.

Official Preparation.

Extractum Æthereum.

Also contained in *Decoctum Sarsæ Compositum.*

EXTRACTUM MEZEREI ÆTHEREUM—Ethereal Extract of Mezereon.—*Take of mezereon bark, cut small,* 1 *pound; rectified spirit,* 8 *pints; ether,* 1 *pint. Macerate the mezereon in* 6 *pints of the spirit for three days, with frequent agitation. Strain and press. To the residue of the mezereon add the remainder of the spirit, and again macerate for three days, with frequent agitation. Strain and press. Mix and filter the strained liquors. Recover the greater part of the spirit by distillation. Evaporate what remains to the consistence of a* *soft extract. Put this into a stoppered bottle with the ether, and macerate for twenty-four hours, shaking them frequently. Decant the ethereal solution. Recover part of the ether by distillation, and evaporate what remains to the consistence of a soft extract.*

It is contained in *Linimentum Sinapis Compositum* (8 grains in 1 ounce).

Therapeutics.—Mezereon acts in over-doses as an acrid poison, and topically as a powerful irritant, the bark causing vesication when moistened and bound upon the skin. Internally it acts as a stimulating diaphoretic and alterative, and is useful in rheumatic and venereal diseases. It is seldom given alone, but enters into the compound decoction of sarsaparilla. A few grains of the bark chewed act as a masticatory.

Substitutes.—The bark of *D. Gnidium* is official in France. It closely resembles the others, but is darker in colour, and the bark of the younger stems and branches is marked with numerous closely-set, whitish, leaf-scars; the leaves, if present, are much narrower. *D. alpina*, and *D. Cneorum* barks are also used. The action of all is very similar.

Nat. Ord. **SANTALACEÆ**—The Sandal-Wood Order.—Trees, shrubs, or herbs, widely distributed in warm countries. The wood of many of the trees is fragrant, and contains volatile oil.

Official Plant.

Name.	Part Used.	Habitat.
SANTALUM ALBUM.	Volatile oil.	India, Malay Archipelago, Pacific Islands.

Santalum album—Sandal-Wood Tree—Sanders-Wood—Yellow Sandal-Wood—White Sandal-Wood—Chandan—Chandal.

The yellow is the heart-wood, the white is the sap-wood of the same tree. The oil is chiefly obtained from the yellow wood, hence the name ; the yield is about 2 to 5 per cent.

OLEUM SANTALI — *Oil of Sandal-Wood* — *Syn.* Oleum Santali Flavi.—The oil distilled in Britain from the wood of *Santalum album*, Linn. (*Syrium myrtifolium*, Roxb.).

Characters and Tests.—Thick in consistence, pale-yellow in colour, a strongly aromatic odour, a pungent and spicy flavour, and neutral or slightly acid in reaction. Its specific gravity is usually about 0·96. It is readily soluble in alcohol.

Dose.—10 to 30 minims.

Composition. — The oil contains two oxidised hydrocarbons, $C_{15}H_{24}O$ and $C_{15}H_{26}O$, which impart the thick consistence.

Therapeutics.—It is employed as a remedy in gonorrhœa, gleet, and other chronic inflammations of the genito-urinary canal. It is excreted in the urine, which it renders antiseptic and stimulant, and on the addition of nitric acid a cloudy precipitate forms which may be mistaken for albumin.

Adulterations.—Cheaper oils, the probable presence of which may be controlled by the B.P. characters and tests. Sandal oil varies much in quality even when genuine.

Nat. Ord. **ARISTOLOCHIACEÆ**—The Birthwort Order.—Herbs or climbing shrubby plants, widely distributed, but chiefly in tropical South America. The plants possess pungent, aromatic, stimulant, and tonic properties.

Official Plants.

Name.	Part Used.	Habitat.
ARISTOLOCHIA SERPENTARIA. A. RETICULATA.	Dried rhizome and rootlets.	Southern United States.

Aristolochia Serpentaria—Virginian Snakeroot.—Serpentary.

A. reticulata—Texan Snakeroot—Red River Snakeroot.

SERPENTARIÆ RHIZOMA—*Serpentary Rhizome*—*Syn.* Serpentariæ Radix.—The dried rhizome and rootlets of *Aristolochia Serpentaria*, Linn. (*A. officinalis*, Nees ; *A. sagittata*, Muhl. ; *A. hastata*, Nutt) ; or of *Aristolochia reticulata*, Nutt.

Characters.—Rhizome twisted ; about an inch long, and $\frac{1}{8}$ inch in diameter, marked above by the remains of former stems, and giving off below an interlacing tuft of numerous slender branched rootlets, about 2 to 4 inches long ; colour dull yellowish-brown. Odour aromatic and camphoraceous ; taste bitterish, aromatic, and camphoraceous.

The rhizome and rootlets of *A. reticulata* agree essentially with above, but the rhizome is slightly thicker, and the rootlets longer, coarser, and less matted together.

Dose.—10 to 30 grains.

Active Principles.—The rhizome contains a *volatile oil* ($\frac{1}{2}$ to 1 per cent.), *resin*, *tannin*, &c. *Aristolochin*, a yellowish, very bitter substance soluble in water and alcohol, and *Aristolochic Acid* are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	No. 20 powder.	1 in 40.	1 to 2 fluid ounces.
Tinctura.	,, 40 ,,	1 in 8.	$\frac{1}{2}$ to 2 fluid drachms.

Also contained in *Tinctura Cinchonæ Composita* (1 in 40).

INFUSUM SERPENTARIÆ—INFUSION OF SERPENTARY.—*Take of serpentary root, in No.* 20 *powder,* $\frac{1}{4}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

TINCTURA SERPENTARIÆ—TINCTURE OF SERPENTARY.—*Take of serpentary root, in No.* 40 *powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Made by maceration and percolation.*

Therapeutics.—Serpentary is an aromatic, bitter tonic, and has been used in dyspepsia, especially when nervous depression is present. It has also slight diaphoretic and diuretic properties, which are of some value perhaps in the treatment of chronic rheumatism. It is now scarcely at all used in this country. Formerly it had a reputation as an emmenagogue and as an antidote to the bites of snakes and rabid dogs.

Adulterations and Substitutes.—The root of *Spigelia marilandica*, Linn., which wants the peculiar smell and taste of serpentary; the roots of *Cypripedium pubescens*, Linn., and of *Hydrastis canadensis*, Linn., although sometimes found mixed with it, bear it very little resemblance, and are therefore easily detected. The rhizome of *Polemonium reptans*, Linn., resemble it closely, but are nearly white. Other rhizomes are occasionally inadvertently gathered with it.

Nat. Ord. **EUPHORBIACEÆ**—The Spurgewort Order.—Trees, shrubs, or herbs, occasionally in North America, Africa, India, and

Europe ; abounding in Equinoctial America. The plants furnish a milky juice, starchy matter, oils, and caoutchouc. They are generally acrid and poisonous.

Official Plants.

Name.	Parts Used.	Habitat.
Croton Eluteria.	Dried bark.	West Indies.
Croton Tiglium.	Expressed oil from seeds.	East Indies.
Ricinus communis.	"	India.
Mallotus philippinensis.	Glands and hairs from fruit.	India, China, Philippines, Arabia, Australia, &c.

Croton Eluteria—Cascarilla Tree—Bahama Cascarilla.

Cascarillæ Cortex.—*Cascarilla Bark*—*Sweetwood Bark*—*Sweet Bark.*—The dried bark of *Croton Eluteria*, J. J. Bennett (*Clutia Eluteria*, Linn.).

Characters.—In quills, 1 to 3 inches in length, and from $\frac{1}{6}$ to $\frac{1}{2}$ inch in diameter, dull brown, easily separable corky layer, more or less coated with whitish lichens[1] ; breaks with a short resinous fracture ; is warm and nauseously bitter to the taste ; emits a fragrant odour, especially when burned.

[1] Verrucaria albissima Ach.

Dose.—15 to 30 grains.

Active Principles.—It contains a *volatile oil* (about $1\frac{1}{2}$ per cent.) which is a mixture of a terpene and an oxidised hydrocarbon, and a bitter principle, *Cascarillin*, $C_{12}H_{18}O_4$, readily soluble in ether or hot alcohol, very sparingly in water, chloroform, or spirit. *Tannin*, *gum*, *starch*, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	No. 20 powder	1 in 10.	1 to 2 fluid ounces.
Tinctura.	" 40 "	1 in 8.	$\frac{1}{2}$ to 2 fluid drachms.

INFUSUM CASCARILLÆ—Infusion of Cascarilla.—*Take of cascarilla bark, in No. 20 powder, 1 ounce; boiling distilled water, 10 fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

TINCTURA CASCARILLÆ—Tincture of Cascarilla.—*Take of cascarilla bark, in No. 40 powder, 2½ ounces; proof spirit, 1 pint. Made by maceration and percolation.*

Therapeutics.—Cascarilla acts as a non-astringent aromatic bitter tonic. It has been used as a substitute for cinchona bark, as a tonic and febrifuge. Its preparations are commonly used as aromatic and tonic adjuncts to other medicines, in atonic dyspepsia, in convalescence from exhausting diseases, in chronic bronchial complaints, in chronic diarrhœa, and dysentery, &c. It burns with a pleasant smell, and is a common ingredient of fumigating pastilles.

Adulterations and Substitutes.—Spurious bark is sometimes found, probably from *Croton lucidus*, Linn., which has an astringent taste without bitterness or aroma. Copalchi Bark (quina blanca) is derived from *Croton nivens*, a shrub growing in Mexico, West Indies, &c.; the quills are longer, stouter, and thicker than those of Cascarilla, which it closely resembles in odour and taste. Malambo Bark, from *Croton Malambo*, Karsten, is in large quills closely resembling the preceding.

Croton Tiglium—The Croton Tree—Purging Croton—Jamalgota—Jepal.

Oleum Crotonis—*Croton Oil.*—The oil expressed in Britain from the seeds of *Croton Tiglium*, Linn. (*T. officinale*, Klotzsch; *Croton Jamalgota*, F. Hamilton).

It is a small tree; the fruit is a 3-celled capsule about the size of a hazel-nut, with a single seed in each cell. The seeds are about ½ inch long and ⅜ inch wide, the surface being a uniform dull cinnamon colour or mottled with black, and the kernel oily. The kernels yield 50 to 60 per cent. of oil.

Characters.—The oil is brownish-yellow to dark reddish-brown, fluorescent, with a viscid consistence which is increased by age; odour faint, peculiar, somewhat rancid and disagreeable; taste oily and acrid. Entirely soluble in alcohol.[1]

Dose.—⅓ to 1 minim.

[1] The solubility in alcohol varies very considerably; the older is more soluble than the fresh, and the more irritating parts of the oil seem the more soluble. Evidently chemical changes occur in the oil gradually and alter its properties.

Composition.—The oil consists of *glycerides* of *palmitic*, *stearic*, *lauric*, *myristic*, *formic*, *acetic*, and other fatty acids. It is doubtful if any or if all of these form the active constituent. Formerly it was thought that two active substances—one pustulant, the other purgative—were present, but this view is now abandoned. The latest view is that *Crotonoleic Acid* is the irritant drastic substance, being especially active when free, and much less so if combined with glycerine. When uncombined it is soluble in alcohol, when combined it may be set free by treatment with baryta, purifying and then decomposing the baryta compound with sulphuric acid. Besides the oil, the seeds contain *albumin* and a *resin*. They also contain an albumose of the same nature as *Ricin* (see castor oil), which is very poisonous.

Official Preparation.

Linimentum Crotonis, ... 1 in 8.

LINIMENTUM CROTONIS—LINIMENT OF CROTON OIL.—*Take of croton oil*, 1 *fluid ounce; oil of cajuput*, *rectified spirit*, *of each* $3\frac{1}{2}$ *fluid ounces. Mix.*

Therapeutics.—Croton oil in over-doses acts as an irritant poison. In medicinal doses of half, one, two, or three drops it is a prompt drastic cathartic, operating freely in an hour or two after its administration. It usually procures several watery evacuations, and causes considerable depression of the vital powers. It is employed as an internal remedy in those cases in which an immediate action of the bowels is imperative, and in cases in which, from inability or obstinate refusal to swallow, the patient is unable or unwilling to take a solid drug, or one in large quantity. It is given to overcome obstinate constipation, in dropsies, and to act as a derivative in head cases. Although so powerful a purgative, it does not frequently cause nausea or griping, but in some cases it produces severe hypercatharsis, and has been known to induce intussusception of the bowels. It is somewhat uncertain in its action, sometimes operating severely in small doses, at other times very slightly even when given in full doses. In consequence of its acrid and depressing qualities, it is contra-indicated in inflammatory affections of the alimentary canal and in cases of debility. When rubbed upon the skin, croton oil produces redness and inflammation, followed by a pustular eruption; it operates, therefore, as a counter-irritant, and is useful in a variety of inflammatory affections of internal organs. When rubbed upon the abdomen it sometimes produces its purgative effects.

It may cause an erysipelatous inflammation, and it is better not to apply it to exposed parts, such as the face and neck. It is best given in pill, with confection of roses, or added to a purgative pill mass, or in a solution of castor oil. Treatment of an over-dose, opiates and demulcents.

Substitutes.—The seeds of *Croton Pavanæ*, Hamilton, of *C. oblongifolius*, Roxb., and of *Baliospermum montanum*, Müll. Arg.—all natives of India or Further India, resemble Croton seeds, and are purgative.

Ricinus communis—The Castor Oil Tree.

OLEUM RICINI—*Castor Oil.*—The oil expressed from the seeds of *Ricinus communis*, Linn. (*R. europæus*, Nees ; *R. lævis*, D.C., &c.).

The tree is a native of India, but is now cultivated in nearly all warm and temperate climates. In favourable regions it attains a height of 40 feet, along the Mediterranean shores it is a tree 10 or 15 feet high, and in Germany and the South of England, where it is only cultivated for ornamental purposes, it is a shrub. The fruit is a 3-celled capsule; the seeds are ovoid, about $\frac{3}{5}$ inch long and $\frac{2}{5}$ broad, their surface being beautifully marbled. The nucleus yields about 40 to 50 per cent. of oil. The best oil is obtained by simple expression without the aid of heat ("cold-drawn") or solvents, which both tend to make it acrid. The name "Castor" was applied first in Jamaica, where the plant was called "Agnus Castus" apparently by mistake. Ricinus means a dog-tick, to which insect the seed bears some resemblance. It is sometimes called *Palma Christi Oil.*

Characters.—Castor oil is viscid, colourless, or pale straw-yellow, having scarcely any odour, and a mild taste at first, but subsequently acrid and unpleasant. Entirely soluble in one volume of absolute alcohol, and in two volumes of rectified spirit.

Dose.—1 to 8 fluid drachms.

Chemistry.—The oil consists of *Palmitic Acid* and *Ricinoleic Acid*, combined with *glycerine.* These are supposed by some to be the purgative substances, but other authorities maintain that the true active principle of the oil is a small quantity of a body derived from the seeds. The oil extracted by means of alcohol is certainly more powerful than the expressed oil, which seems to confirm this view. Ricinoleic acid, $C_{18}H_{34}O_3$, is a yellowish liquid of feeble odour and sharp taste.

Ricin is the poisonous principle of the seeds. It is an albumose of extreme toxicity, and causes symptoms similar to the seed. *Ricinine*, which has also been described, is not poisonous, and is a compound of magnesia with a vegetable acid. *Resin*, *gum*, &c., are also found in the seed.

Official Preparation.

Mistura, . 1 in 4 about. *Dose*, 1 to 2 fluid ounces.

MISTURA OLEI RICINI—Castor Oil Mixture.—*Take of castor oil*, 6 *fluid drachms; oil of lemon*, 10 *minims; oil of cloves*, 2 *minims; syrup*, $1\frac{1}{2}$ *fluid drachms; solution of potash*, 1 *fluid drachm; orange-flower water, sufficient to produce* 2 *fluid ounces. Mix the oils in a mortar, then incorporate one-third of the solution of potash, and afterwards the syrup, then an additional third of the solution of potash, then gradually, half of the orange-flower water, the remainder of the solution of potash, and lastly, sufficient orange-flower water to produce the required volume.*

This is a potash soap. It is difficult to make well, and is apt not to remain as an emulsion. There are many better formulæ for disguising the taste of castor oil.

Therapeutics.—Castor oil acts as a mild simple purgative, causes no pain, and no constitutional disturbance. It produces little irritation of the alimentary mucous membrane, and is therefore enormously used as a safe laxative in delicate people generally, in pregnancy and after parturition, in inflammatory affections of the abdominal and pelvic viscera, after operations, in typhoid fever, &c. If rancid or carelessly prepared it is sometimes irritating and too violent in action, and in some persons it causes extreme nausea. It may be given alone, or as an emulsion, or in coffee, spirits, aromatic waters, &c., to cover the taste and smell.

The seeds are extremely poisonous—one, two, or three cause violent purgation, vomiting, pain, and depression, while twelve to fifteen have proved fatal in adults with similar symptoms. The *post-mortem* appearances are inflammation and swelling of the gastro-intestinal mucous membrane, with numerous hæmorrhages. The treatment consists in giving stimulants, demulcents, and opiates.

Adulteration.—Castor oil is not adulterated as a rule.

Mallotus philippinensis.—The Kamala Tree.

KAMALA—*Kamala—Kamela—Glandulæ Rottleræ—Wars* (Arabic)—*Wurrus.*—A powder which consists of the minute glands and hairs obtained from the surface of the fruits of *Mallotus philippinensis*, Müll. Arg. (*Rottlera tinctoria*, Roxb.; *Croton philippinense*, Lam., &c.).

Characters and Test.—A fine granular mobile powder of a brick-red or madder colour, and nearly tasteless and inodorous. Water has scarcely any effect on it, even at a boiling temperature; but it forms deep red solutions with alcohol, ether, or chloroform.[1] When examined by the microscope it is seen to consist of irregular spherical, flattened, or depressed garnet-red glands with wavy surfaces, mixed with nearly colourless thick-walled stellate hairs. On ignition in air it should yield 4 or 5, or at most 10, per cent. of ash.[2]

Dose.—30 grains to ½ ounce.

[1] The colouring matter of genuine kamala is insoluble in water, but soluble in these menstrua. [2] Absence of inorganic red powdered adulterants.

Active Principles.—It contains about 80 per cent. of *resins*, one more soluble than the other in alcohol, both soluble in alkalis, from which they are precipitated unchanged by acids. *Rottlerin* ($C_{22}H_{20}O_6$), a crystalline body, which is deposited from an ethereal solution of kamala on standing for some days, insoluble in water, soluble in hot alcohol; *red colouring matter*, *ash*, &c.

Therapeutics.—Kamala is employed in India and other countries as a dye-stuff and as an anthelmintic. It acts as a prompt purgative, causing more or less of nausea and griping; but its chief medicinal value resides in its vermifuge properties, on account of which it is employed for the removal of tape-worm. To persons of weakly condition rather a small dose should be given, as it is apt to purge frequently. It may be given along with liquid extract of male fern in emulsion, or alone in mucilage, syrup, or honey.

Adulterations and Substitutes.—It is a good deal adulterated with inorganic matter, this being best detected by incineration, but it also sinks in water and is gritty. Often there is an excessive proportion of inert vegetable matter, pieces of leaves, twigs, &c. A coarser kind of Wars imported from Arabia or East Africa is sometimes seen. It is the product of *Flemingia rhodocarpa*, Baker (a papilionaceous plant), is of a deep purple colour, has a slight smell, and becomes black when heated on the water-bath.

Euphorbia resinifera—The Euphorbium Plant—(*not official*).

EUPHORBIUM—*Euphorbium*—(*not official*).—A resinous exudation from incisions into the branches of *Euphorbium resinifera*, Berg. It is a leafless plant, very like a cactus, growing about 4 feet high, and found on the mountains of Morocco. The dried exudation is in nodular pieces, dull brownish-yellow and brittle; nearly inodorous, the dust causing violent sneezing; taste very acrid; partly soluble in alcohol and ether; triturated with water it makes an incomplete emulsion.

The *constituents* are *gum* (about 18 per cent.), *amorphous resin* (about 38 per cent.), *Euphorbon* (a crystalline body), *salts*, &c. The resin is the active constituent.

Therapeutics.—Formerly it was used as an emetic and purgative, but was much too drastic in its action. It is sometimes employed as a rubefacient in plasters well diluted, and as a pustulant, but not in this country.

Euphorbia pilulifera. — Pill-bearing Spurge — (*not official*). — *Habitat*, Australia, America, &c.

The whole herb collected when in flower and dried is used. It contains *gum*, *resin*, *tannin*, &c., but the active constituent is not known.

TINCTURA EUPHORBIÆ PILULIFERÆ — TINCTURE OF EUPHORBIA PILULIFERA, B.P.C.—(*not official*).—*Take of euphorbia, in No.* 20 *powder*, 4 *ounces; proof spirit, a sufficient quantity. Macerate for twenty-four hours, then percolate until* 1 *pint of tincture is obtained.*

Dose.—10 to 30 minims.

Therapeutics.—It has been highly recommended in bronchial asthma.

Nat. Ord. **URTICACEÆ**—The Nettle and Hemp Order.—Trees, shrubs, or herbs. The order is divided into two sub-orders:—1. *Urticeæ*, Nettleworts, the true Nettles, which are universally distributed; and 2. *Cannabineæ*, Hempworts, the Hemp and Hop tribe, natives chiefly of temperate regions. The plants possess tonic, narcotic, and other properties.

Official Plants.

Name.	Parts Used.	Habitat.
HUMULUS LUPULUS.	Dried strobiles, and a glandular powder obtained from them.	Indigenous.
CANNABIS SATIVA.	Dried flowering or fruiting tops.	India.

Humulus Lupulus—The Hop.

LUPULUS—*Hop*—*Syn.* Humulus.—The dried strobiles of *Humulus Lupulus*, Linn., from plants cultivated in England.

Botany.—*Root*, perennial. *Stems*, annual, long, weak, pliable, climbing, scabrous. *Leaves*, opposite, on long, often winding petioles, three- to five-lobed, sharply serrated, rough. *Flowers*, numerous, diœcious, greenish-yellow; male flowers in loose panicles, female flowers in catkins or strobiles, male and female flowers on separate plants. *Habitat*, indigenous, various parts of Europe, cultivated in the south of England. *Flowering time*, July and August. *Fruit*, ripe at end of September.

Characters.—Generally compressed and broken, but if entire about 1¼ inch long; oblong-ovoid or rounded, and consisting of a number of thin greenish-yellow or brownish membranous imbricated scales or bracts; each of which has at its base a small rounded achene sprinkled over with brownish-yellow glands,[1] the whole being attached to a hairy undulated axis. Odour agreeably aromatic; taste bitter, aromatic, and feebly astringent.

[1] The official Lupulin.

Lupulinum—*Lupulin*—*Lupulinic Glands.*—A glandular powder obtained from the dried strobiles of *Humulus Lupulus*, Linn.

Characters and Tests.—A granular, bright brownish-yellow powder, which, under the microscope, is seen to consist of minute, somewhat globular or hood-shaped,[1] reticulated,[1] translucent, shining glands. It burns readily, and has the agreeable aromatic odour and taste of hop. On incineration it should not yield more than about 15 per cent. of ash.[2] Not more than about 30 or 40 per cent. should be insoluble in ether.

Dose.—2 to 5 grains.

[1] Foreign admixtures have not this structure. [2] Showing absence of excessive inorganic matter. 5 or 7 per cent. ash is common in good lupulin.

Composition.—The aromatic and bitter principles are chiefly in the glands The glands consist of a *volatile oil* (about 3 per cent.) and *resins* and *wax*. There is a bitter substance, *Lupamaric* or *Lupulinic Acid*, $C_{25}H_{35}O_4$, in crystalline prisms, insoluble in water, becoming resinous on exposure to air; *Trimethylamine*, and a volatile liquid alkaloid, *Lupuline*, are also present.

Hops contain less than 1 per cent. of the *volatile oil*, *resin* about 9 to 18 per cent. *asparagin* and *tannin*, but, as previously stated, the active substances are contained very largely in the glands. The volatile oil contains *valerol*, C_6H_{10}, which on exposure to air tends to resinify, and yields valerianic acid.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Dried strobiles.	...	5 to 15 grains.
Infusum.	" "	1 in 20.	1 to 2 fluid ounces.
Tinctura.	" "	1 in 8.	$\frac{1}{2}$ to 2 fluid drachms.

EXTRACTUM LUPULI — EXTRACT OF HOP. — *Take of hop, 1 pound; rectified spirit,* $1\frac{1}{2}$ *pint; distilled water,* 1 *gallon. Macerate the hop in the spirit for seven days, press out the tincture, filter, and distil off the spirit, leaving a soft extract. Boil the residual hop with the water for one hour, press out the liquor, strain, and evaporate by a water-bath to the consistence of a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding* 140° *F.* (60° *C.*) *until it has acquired a suitable consistence for forming pills.*

INFUSUM LUPULI—INFUSION OF HOP.—*Take of hop,* $\frac{1}{2}$ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for one hour, and strain.*

TINCTURA LUPULI—TINCTURE OF HOP.—*Take of hop,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Made by maceration and percolation.*

Therapeutics.—The aroma of hops is said to act as a narcotic, and in order to procure this effect, in certain cases of nervous restlessness, or watchfulness and insomnia, the patient is made to use a pillow stuffed with the catkins. As an internal remedy hops and lupulin are also feebly narcotic. The official preparations act as mild aromatic tonics and stomachics, and are very extensively used in the form of bitter beer. Hops and their preparations have been used both internally and by local application to procure sleep in insomnia and delirium, in spasms, in painful tumours, &c., but if pain be severe the narcotic effect of hops is not sufficient to overcome it.

Adulterations.—Lupulin may contain sand or other extraneous matters. If it be too long kept the volatile oil resinifies.

Cannabis sativa—Hemp—The Hemp Plant.

CANNABIS INDICA—*Indian Hemp—Hemp—Bhang—Ganja—Gunjah.*—The dried flowering or fruiting tops of the female plants of *Cannabis sativa*, Linn. (*Cannabis indica*, Lam., *C. chinensis*, Del.); grown in India, and from which the resin has not been removed. It is known in India as Gunjah or Ganga.

Botany.—An annual, generally diœcious. *Root*, white, fusiform *Stem*, 3 to 6 or more feet high, erect, simple when crowded, branched when growing apart, angular, pubescent. *Leaves*, on long weak petioles, opposite or alternate, digitate, scabrous; leaflets, five to seven, narrow, lanceolate, sharply serrated. *Stipules*, subulate. *Inflorescence*, males, racemose; females in spikes. *Fruit*, ovate, one-celled, with a solitary seed. Cultivated in India.

The hemp is a native of the temperate parts of Asia near the Caspian Sea, &c., and probably also of Northern India and China. It has spread into all temperate and warm countries, where it is cultivated for the sake of its fibre and the oil derived from its seeds. Indian hemp differs in no way from the common variety botanically, but when grown in India and other warm climates the plant secretes a resin which has active intoxicant and narcotic properties.

Cannabis indica occurs in three forms, *Gunjah*, *Churrus*, and *Bhang*. *Gunjah* is the flowering or fruiting shoots of the female plants, and it alone is official (see below). *Churrus* consists simply of the resin obtained from the leaves, slender stems, and flowers. It is obtained by rubbing the leaves carefully between the palms of the hands and scraping the soft resin from them when enough has adhered; by rubbing the leaves gently with a cloth, and scraping the resin off it, or by making men in leather garments walk among the plants, and then scraping off the resin which adheres to them. *Bhang* consists of a mixture of the leaves and capsules without the stalks. *Haschhisch* is the Arabic word for hemp.

Hemp is smoked alone or mixed with tobacco, and is also eaten. It is taken plain or as churrus, or made up as a sweetmeat, or with fats. Probably about 300 or 400 millions of people use it in these ways.

Characters.—In small more or less aggregated masses, from about $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, and consisting of the tops of one or more alternate branches bearing the remains of the flowers and smaller leaves with a few ripe fruits, and the whole pressed together by adhesive resinous matter; or it is composed of straight, stiff, woody stems, several inches long, surrounded by the branched flower-stalks. It is rough to the touch, very brittle, of a dusky-green colour, with scarcely any taste, but having a faint, peculiar, narcotic, not unpleasant odour.

Dose.—3 to 15 grains.

Active Principles.—The active principle has not yet been isolated pure, but it resides in the resin. There is some *volatile oil* (chiefly $C_{10}H_{16}$) and *choline* present. *Tetanocannabine*, a body giving alkaloidal reactions and having a tetanising action, has been described, but it seems to be choline simply. Gunjah yields 6 or 7 per cent. of resin.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Cannabis Indica.	...	$\frac{1}{4}$ to 1 grain.
Tinctura.	Extract.	22 grains in 1 fluid ounce nearly.	5 to 20 minims.

EXTRACTUM CANNABIS INDICÆ—EXTRACT OF INDIAN HEMP.—*Take of Indian hemp, in coarse powder,* 1 *pound; rectified spirit,* 4 *pints. Macerate the hemp in the spirit for seven days, and press out the tincture. Distil off the greater part of the spirit, and evaporate what remains by a water-bath to the consistence of a soft extract.*

TINCTURA CANNABIS INDICÆ—TINCTURE OF INDIAN HEMP.—*Take of extract of Indian hemp,* 1 *ounce; rectified spirit,* 1 *pint. Dissolve the extract of hemp in the spirit.*

Therapeutics.—Indian hemp is employed in many countries for the purpose of intoxication. Taken thus in large doses, it quickens the circulation and exhilarates the spirits, producing a kind of mirthful or extravagant delirium, during which the sensations are pleasurable and visionary. There is often extravagant muscular movements with dancing, singing, and loud laughter. Double consciousness, catalepsy, and a loss of appreciation of time and space are also frequent. Sometimes, however, it makes its victim ill-tempered, violent, and pugnacious. It may produce an inordinate appetite for food, or act powerfully as an aphrodisiac. In medicinal doses it acts upon the cerebro-spinal system, causing exhilaration of spirits, a kind of inebriation and hallucination, followed by confusion of intellect and tendency to sleep; in large doses it causes stupor. Cannabis indica has been most frequently used in this country as a substitute for opium in cases in which the latter is not tolerated. It differs from opium in its effects, chiefly in not contracting the pupil, and in not causing loss of appetite, dry tongue, or constipation. The great drawback to its employment is its exceeding uncertainty of action, small doses in some cases causing marked symptoms, whilst in other instances full doses produce no effect, circumstances which depend, however, a good deal upon the purity of the drug. It has been used as an anodyne, hypnotic, antispasmodic, &c., and has been employed in tetanus, hydrophobia, chorea, infantile convulsions, delirium tremens, various forms of neuralgia, in headache with dull throbbing pain, in gout, rheumatism, in low fevers, in hysteria, in asthma, in palpitation of the heart, in menorrhagia, in protracted labour depending upon an atonic state of the uterus, &c. It is contra-indicated in active inflammatory states, and the patient must be carefully watched during its exhibition, lest he should injure himself whilst mentally incapacitated by it, as sometimes happens. On the whole, it has been disappointing in its therapeutic effects.

Cannabis Americana.—The hemp grown in the Southern United States is official in the U.S.P. Its action is the same as Indian hemp.

Nat. Ord. **ARTOCARPACEÆ**—The Bread-fruit or Mulberry Order. Trees or shrubs. The order is divided into two sub-orders:—1. *Artocarpeæ*, the Bread-fruit tribe, natives of the tropics. 2. *Moreæ*, the Mulberry and fig tribe, inhabiting tropical and temperate climates. Many of the plants of the order furnish edible fruits; they possess bitter, tonic, acrid, and poisonous properties.

Official Plants.

Name.	Part Used.	Habitat.
MORUS NIGRA.	Juice of fruit.	Indigenous.
FICUS CARICA.	Dried fruit.	Syria and Asia Minor.

Morus nigra—The Mulberry.

Botany.—A tree, 20 to 30 feet high. *Leaves*, alternate, cordate, lobed, coarsely serrated, pubescent. *Flowers*, greenish, monœcious; male flowers in spikes; female flowers in small roundish or ovoid catkins. *Fruit*, dark purple, formed by the female flowers becoming fleshy and coherent, and including a dry membranous one-seeded pericarp. *Habitat*, Persia and China; cultivated in Britain.

MORI SUCCUS—Mulberry juice.—The juice of the ripe fruit of *Morus nigra*, Linn.

Characters.—Of a dark violet colour, with a faint odour, and an acidulous sweet taste. Specific gravity about 1·060.

Constituents.—Chiefly *grape sugar* and *salts*, with *free acids*, mostly *malic* and *tartaric*, *albumen*, *colouring matter*, &c.

Official Preparation.

Syrupus, . . *Dose*, 1 fluid drachm.

SYRUPUS MORI—Syrup of Mulberries.—*Take of mulberry juice*, 1 *pint ; refined sugar*, $2\frac{1}{4}$ *pounds ; rectified spirit*, $2\frac{1}{2}$ *fluid ounces. Heat the mulberry juice to the boiling point, and when it has cooled, filter it. Dissolve the sugar in the filtered liquid with a gentle heat, and add the spirit. The product should weigh* 3 *pounds* 6 *ounces, and should have the specific gravity* 1·33.

Therapeutics.—Mulberry juice is occasionally used as a refrigerant; in large doses it is laxative. The syrup is used to impart colour and flavour to mixtures.

Ficus Carica—The Fig Tree.

Ficus—Fig.—The dried fruit of *Ficus Carica*, Linn.

Characters.—The fig consists of the enlarged hollow succulent receptacle, bearing very numerous seed-like achenes on its inner surface. It is compressed, irregular in form, soft, tough, more or less translucent, brownish or yellowish, and covered with a saccharine efflorescence. Taste luscious ; odour fruity and pleasant.

Contained in *Confectio Sennæ* (1 in 6 nearly).

Composition.—About 60 or 70 per cent. *grape sugar*, *woody matter*, *water*, *gum*, *fat*, &c.

Therapeutics.—Figs act as demulcents and laxatives. They are chiefly used as dessert, and are sometimes given to overcome chronic constipation. When split and heated, they are sometimes applied to boils or gum-boils.

Nat. Ord. **ULMACEÆ**—The Elm Order.—Trees or shrubs inhabiting northern countries. The plants possess bitter and astringent properties.

Ulmus campestris, Linn.—The Elm Tree—Elm.—*Habitat*, indigenous—(*not official*).

The *bark* was formerly official. It occurs in pieces, tough and brownish-yellow, about half-a-line thick, without smell ; taste mucilaginous, slightly bitter and astringent. Its decoction is turned green by perchloride of iron, and precipitates with a solution of gelatine.

The active principles are *tannin* and *mucilage*. It was formerly given as a decoction ($2\frac{1}{2}$ ounces in 1 pint; dose, 2 to 4 ounces) in chronic scaly skin diseases, as a demulcent drink, and used externally as an emollient.

Ulmus fulva—Slippery Elm.—*Habitat*, North America—(*not official*).

The *bark*, deprived of its outer layer, is official in the U.S.P. It occurs in flat pieces of varying size, about $\frac{1}{8}$ inch thick, tough, brownish-white, the inner surface finely ridged; fracture fibrous; odour slight; taste mucilaginous and insipid.

Mucilage is the important constituent. Poultices of the bark are used alone or with lead lotion in erysipelas and other inflammation. Internally a decoction may be given, *ad lib.*, as a diuretic and demulcent in gastro-intestinal and urinary disorders.

Nat. Ord. **PIPERACEÆ**—The Pepper Order.—Shrubs or herbs, natives of tropical regions. The plants of this order contain acrid resin, volatile oils, &c.; they possess pungent, aromatic, astringent, and narcotic properties.

Official Plants.

Name.	Parts Used.	Habitat.
PIPER NIGRUM.	Dried unripe berries.	Southern India and the East and West Indies.
„ CUBEBA.	Dried unripe berries and volatile oil.	Java, Sumatra, &c.
„ ANGUSTIFOLIUM.	Dried leaves.	Tropical America.

Piper nigrum—The Black Pepper Tree.

PIPER NIGRUM—*Black Pepper.*—The dried unripe fruit of *Piper nigrum*, Linn. (*P. trioicum*, Roxb.).

Characters.—Small, about $\frac{1}{5}$ inch in diameter, roundish, wrinkled; tegument brownish-black, containing a greyish-yellow globular seed. Odour aromatic. Taste pungent and bitterish.

Dose.—5 to 20 grains.

The berries are gathered just as their colour is changing from green to red, and during the drying the pericarp becomes blackish-brown. White pepper (*Piper decorticatum*) is prepared from the ripe berries, from which nearly the whole of the pericarp is removed, leaving little but the seeds. They are somewhat larger than the black, round, smooth, and whitish in colour.

Active Principles.—The pungent principle is a *resin*, sometimes called *Chavicin*, of which about 18 per cent. is present, soluble in alcohol, ether, and alkalis; a *volatile oil*, $C_{10}H_{16}$ (about 2 per cent.), which is not pungent, but to which probably the aromatic taste and odour of pepper are due; an alkaloid, *Piperine*, $C_{17}H_{19}NO_3$ (6 to 8 per cent.), in colourless prisms when pure, inodorous, and of a slowly-developing peppery taste, decomposed by alkalis into *Piperic Acid*, $C_{12}H_{10}O_4$, and *Piperidine*, $C_5H_{11}N$, which has a peppery and peculiar odour, and a small amount of which is present in pepper. *Fat*, *proteids*, *starch*, &c.

Official Preparation.

Confectio, . . 1 in 10. *Dose*, 60 to 120 grains.

Contained also in *Confectio Opii* (1 in 31) and in *Pulvis Opii Compositus* (1 in 7½).

CONFECTIO PIPERIS—CONFECTION OF PEPPER.—*Take of black pepper, in fine powder*, 2 *ounces; caraway fruit, in fine powder*, 3 *ounces; clarified honey*, 15 *ounces. Rub them well together in a mortar.*

Therapeutics.—Pepper is largely used as a condiment. As a medicine, it acts as an acrid, aromatic, stimulant stomachic, and as a febrifuge. It is partly excreted in the urine, and stimulates the genito-urinary mucous membrane, while a portion passes down the whole alimentary canal without being absorbed and tones up the rectal mucous membrane. Externally it acts as a rubefacient. It is useful as a stimulant stomachic condiment in atonic and torpid states of the stomach and bowels. It acts as a febrifuge in intermittent fever, a property which it owes to piperine, which may be given alone for that purpose. Pepper is also used as a masticatory in paralysis of the tongue, relaxed uvula, and other affections of the mouth. The confection is employed in diseases of the rectum, such as hæmorrhoids, fistula, ulcers, &c., but in order to afford any benefit, it must be continued for two or three months. Pepper is contra-indicated in inflammatory conditions of the mucous membrane. The dose of piperine is 3 to 10 grains.

Adulterations.—Powdered pepper may be adulterated with starches, mustard husks, and other powdered vegetable matter. Careful microscopic examination for foreign particles is the best means of detection.

Piper Cubeba—The Cubeb Plant.

CUBEBA—*Cubebs*—*Cubeb Pepper.*—The dried unripe full-grown fruit of *Piper Cubeba*, Linn. fil. (*Cubeba officinalis*, Miguel; *P. caudatum*, Houtt).

Characters.—Globular, about $\frac{1}{6}$ inch diameter, blackish or greyish-brown, much wrinkled and tapering below into a rounded stalk,[1] which is continuous with, and permanently attached to, the pericarp. Beneath the shrivelled skin is a hard brown smooth shell, in which the seed is contained in the mature fruit, but in commercial cubebs this seed is usually so little developed that the pericarp is nearly empty. Taste warm, aromatic, and somewhat bitter; odour strong, peculiar, and aromatic. A decoction when cold is coloured bright indigo-blue by solution of iodine.[2]

Dose.—30 to 120 grains.

[1] Distinguishes it from black pepper. [2] Presence of starch.

Active Principles.—The official *volatile oil* (5 to 15 per cent.) and about 3 per cent. *resin* are the chief active constituents; *Cubebin*, $C_{10}H_{10}O_3$, in white pearly crystals, which may sometimes be seen in the pericarp, soluble in chloroform, ether, and hot alcohol, but deposits from the last on cooling; by treatment with caustic potash it is resolved into acetic and proto-catechuic acids. *Cubebic Acid*, an acid resin (about 1 per cent.), is also present. *Fat*, *wax*, *starch*, &c.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Oleo-resina.	Coarse powder.	...	5 to 30 minims.
Oleum.	Dried fruit.	...	5 to 20 „
Tinctura.	In powder.	1 in 8.	$\frac{1}{2}$ to 2 fluid drachms.

OLEO-RESINA CUBEBÆ—OLEO-RESIN OF CUBEBS.—*Take of cubebs, in coarse powder, 2 pounds; ether, 4 pints or a sufficiency. Percolate until the ether passes colourless. Evaporate the ether at first spontaneously, and then over the water-bath, or recover it by distillation, and transfer the residue to a closed vessel, letting it stand until waxy or crystalline matter ceases to be deposited. Decant the oleo-resin, and preserve in a well-stoppered bottle.*

OLEUM CUBEBÆ—OIL OF CUBEBS.—The oil distilled in Britain from Cubebs.

Characters.—Colourless or greenish-yellow, with the odour and taste of cubebs. Its specific gravity is 0·92, not freely soluble in 80 per cent. alcohol, and gives a red colour with warm sulphuric acid. It consists of *terpenes* $C_{10}H_{16}$, $C_{15}H_{24}$, and *cubebs camphor*, $C_{30}H_{48} . 2H_2O$.

TINCTURA CUBEBÆ—Tincture of Cubebs.—*Take of cubebs, in powder,* $2\frac{1}{2}$ *ounces; rectified spirit,* 1 *pint. Made by maceration and percolation.*

Therapeutics.—Cubebs, like common pepper, act as an acrid stimulant stomachic, and in over-doses cause griping and purging. They act upon the mucous membranes generally, but especially upon the genito-urinary tract, as the active principles are excreted in the urine, and render it stimulant and antiseptic. The preparations are chiefly employed in the treatment of gonorrhœa and gleet, but also in other affections of the urinary organs, such as pyelitis and cystitis, &c.; also in those affections of the pulmonary mucous membrane in which there is profuse secretion. It does not disturb digestion so much as copaiba. The powder is sometimes used as a snuff in chronic nasal catarrh. An urticaria-like skin eruption is occasionally caused.

Adulterations, &c.—Cubebs are not much adulterated, though they may contain an excessive amount of stalks and other debris. Some other species of *Piper* yield fruits strongly resembling cubebs, and these can only be distinguished by careful examination.

Piper angustifolium.—The Matico Plant.

Maticæ Folia—*Matico Leaves—Matico.*—The dried leaves of *Piper angustifolium*, Ruiz and Pavon (*Artanthe elongata*, Miq.; *P. granulosum*, &c.).

Characters.—From about 4 to 8 inches long, oblong-lanceolate, tapering towards the apex, cordate and unequal at the base, entire or minutely crenulate, greenish-yellow, very shortly petiolate, reticulated with sunken veins and tessellated above, the veins prominent beneath, and the depressions formed by them densely clothed with hairs. Taste aromatic, bitterish; odour pleasant, feebly aromatic. The leaves are usually more or less broken, folded and compressed into a brittle mass, and have mixed with them a variable proportion of the jointed stems, flowers, and fruit.

Dose.—15 to 60 grains.

Active Principles.—The leaves contain about $2\frac{1}{2}$ per cent. *volatile oil*, and some pungent *resin;* a little *tannin* is also present, and a crystalline body, *Artanthic Acid*, *mucilage*, &c.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Infusum.	Leaves cut small.	1 in 20.	1 to 4 fluid ounces.

INFUSUM MATICÆ—INFUSION OF MATICO.—*Take of matico, cut small,* ½ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

Therapeutics.—Matico acts as an aromatic astringent stimulant and stomachic, and may be used internally in the same manner as the preparations of pepper and cubebs. As an internal remedy, its astringent properties are not well marked; and although it acts externally as a reliable hæmostatic, the effect is probably due rather to the mechanical action of the leaf than to astringency. It is given internally in affections of the bladder and rectum, for the same purposes as pepper and cubebs are given; but its chief use is as an external application to check bleeding from small wounds, such as leech-bites. The under surface of the leaf, from its reticulated texture, is said to be more efficacious as a hæmostatic than the upper.

Substitutes.—Leaves of *Piper aduncum*, Linn., closely resemble Matico, but the under-surfaces have more prominent ascending parallel nerves, the spaces between which are smooth and nearly glabrous. The leaves of other species of plants are also called Matico in South America. They all have styptic properties.

Piper Longum—The Long Pepper.—*Habitat*, East Indies—(*not official*).

The dried unripe spike of fruits is also known as *Piper Longum.* It is about 1½ inch long, ⅕ inch thick, cylindrical, blackish-grey; the numerous fruits are arranged spirally, each crowned with the remnant of the style; odour and taste like black pepper.

The *Constituents* and *Uses* are the same as those of black pepper.

Manihot utilissima—The Cassava or Manioc Plant (*Jatropha Manihot*, Linn.; *Janipha Manihot*, Kunth).—*Habitat*, South America, Africa, and Tropics generally—(*not official*).

Tapioca is made from the root, two kinds of which are distinguished, *Bitter Cassava Root* and *Sweet Cassava Root* (from *Jatropha dulcis*, Gmel.; *Manihot Aipi*, Pohl). The latter is innocuous, the former contains a bitter, poisonous juice; but from both cassava meal is obtained by washing and collecting the deposit. The poison is *prussic acid*, which forms only after exposure to the air, and there is also a very active crystalline volatile body, *Manihotoxine.* Heating gets rid of these objectionable substances.

Tapioca is cassava starch which has been heated while moist, and thus agglomerated into small irregular masses. It is a pure form of starch, and is used for making puddings, &c. It is chiefly imported from Brazil, and is sometimes known as Brazilian arrowroot.

Sweet cassava root when boiled or roasted is a common article of food in South America and the West Indies. The juice of the root when fermented forms an alcoholic drink, used by the Indians, and called *Piwarry*.

Nat. Ord. **SALICACEÆ**—The Willow Order.—Trees or shrubs, chiefly inhabitants of northern regions.

Salix alba, Linn.—White Willow—Golden Willow—(*not official*).—The bark of this and many other species, such as *S. caprea*, *S. fragilis*, *S. purpurea*, &c., and various species of *Populus*, furnish Salicin. *Habitat*, Central and Southern Europe, and temperate regions elsewhere, in damp places.

The dried bark is in thin pieces, quilled, brownish externally, whitish within, tough, fibrous, and not easily powdered; odour slight, somewhat aromatic, taste bitter astringent. Besides *Salicin* (1 to 3 per cent.), considerable quantities of *tannic acid* (about 12 per cent.) are present.

Salicinum—Salicin, $C_{13}H_{18}O_7$.—A crystalline glucoside obtained by treating the bark of *Salix alba*, Linn., and other species of *Salix*; and the bark of various species of *Populus*, Linn., with hot water, removing tannin and colouring matter from the decoction, evaporating, purifying, and recrystallising.

Characters and Tests.—Colourless shining crystals, with a very bitter taste. Soluble in about 28 parts of water, or a similar quantity of spirit, at common temperatures; insoluble in ether. Sulphuric acid colours it red. A small quantity heated with a little red chromate of potassium, a few drops of sulphuric acid, and some water, yields vapours of an oil having the odour of meadow-sweet.[1] The crystals melt when heated, and emit vapours having the odour of meadow-sweet.[1] On ignition it leaves no residue.[2]

Dose.—3 to 20 grains.

[1] Due to formation of salicylic aldehyde ($C_6H_4OH \cdot COH$), which is the chief constituent of oil of meadow-sweet (*Spiræa Ulmaria*).
[2] Absence of inorganic impurities.

When heated gently with dilute mineral acids Salicin decomposes into *Glucose* and *Saligenin*,

$$\underset{\text{Salicin.}}{C_{13}H_{18}O_7} + H_2O = \underset{\text{Glucose.}}{C_6H_{12}O_6} + \underset{\text{Saligenin.}}{C_7H_8O_2},$$

but when boiled in the same way *Saliretin* is formed, C_7H_6O, by abstraction of a molecule of water from Saligenin.

On heating Salicin with dilute nitric acid *Salicylic Aldehyde*, $C_7H_6O_2$, forms, and this can readily be converted, by treating it with bichromate of potassium and sulphuric acid, into *Salicylic Acid*, $C_7H_6O_3$.

Therapeutics.—Willow bark has tonic, astringent, and antiperiodic properties, but of a somewhat feeble kind. Its activity is due to salicin, which has been used with great success in the treatment of acute rheumatism, and which has the same action in this disease as salicylate of sodium (which see), but is not so powerful. On the other hand, being bitter, it is better borne by the stomach, it promotes appetite and digestion, and is often substituted for the other when the acute stage of the fever is past. In the body salicin is converted partly into saligenin and salicylic acid. It sometimes causes a rash on the skin.

Nat. Ord. **CUPULIFERÆ**—The Oak Order.—Amentiferous trees or shrubs, abounding in the forests of temperate regions.

Official Plants.

Name.	Part Used.	Habitat.
QUERCUS ROBUR.	Bark.	Indigenous.
„ LUSITANICA, *var.* INFECTORIA.	Excrescences on bark.	Asia Minor, Syria, &c.

Quercus Robur, Linn.—The Common Oak—British Oak.

QUERCUS CORTEX—*Oak Bark.*—The dried bark of the smaller branches and young stems of *Quercus Robur*, Linn. (*Q. pedunculata*, Ehr.; *Q. sessiliflora*, Salisb., &c.). Collected in spring[1] from trees growing in Britain.

Botany.—A handsome tree. *Leaves*, on short foot-stalks, cuneately oblong, pinnatifid, slightly pubescent beneath, deciduous. *Fruit*, two or three acorns upon a long peduncle. *Habitat*, indigenous.

Characters.—In quills covered with a smooth shining silvery or ash-grey, variegated with brown, corky layer;[2] internally cinnamon-brown or reddish, and longitudinally striated; fracture tough and fibrous; taste very astringent;[3] no marked odour.

[1] At this season the bark contains more astringent matter and is more easily separated. [2] The characters vary a good deal, according to the age of the branches from which the bark is taken. [3] Due to the tannin present.

Active Principles.—About 10 per cent. of *Quercotannic Acid*, a little *Gallic Acid*, a sugar *Quercite*, and a bitter, crystalline body, *Quercin*, besides *woody matter*, &c.

Official Preparation.

Decoctum, . . 1 in 16. *Dose*, 1 to 4 fluid ounces.

DECOCTUM QUERCUS—DECOCTION OF OAK BARK.—*Take of oak bark, bruised,* 1¼ *ounce; distilled water,* 1 *pint. Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.*

Therapeutics.—Oak bark is used for the sake of its astringency as a gargle, as an injection, and as a lotion in relaxed throat, leucorrhœa, flabby ulcers, &c. It is not now used internally, but in diarrhœa and other conditions would exert the astringent effects of tannic acid.

Quercus lusitanica, *var.* **infectoria**—The Dyers' Oak.

GALLA—*Galls—Oak Galls—Nut Galls—Gallæ Turcicæ.*—Excrescences on *Quercus lusitanica*, var. *infectoria*, Welb. (*Q. infectoria*, Oliv.), caused by the puncture and deposit of an egg or eggs of Cynips gallæ tinctoriæ.[1]

Characters.—Hard, heavy, subglobular, from about ½ to ¾ inch diameter, tuberculated on the surface, the tubercles and intervening places being smooth; dark bluish-green or olive-green externally, yellowish or brownish-white within, with a small central cavity.[2] No odour; taste intensely astringent, followed by some degree of sweetness.

Dose.—10 to 20 grains.

[1] The eggs are deposited in the tender shoots, and the irritation soon causes the latter to hypertrophy greatly at the spot. The official known as Aleppo, Turkey or Levant galls, but Chinese, Japanese, Californian, and other kinds of galls from different trees are also in the market. [2] Containing the partly developed insect, or, if it has eaten its way out, powdery matter. In the latter case there is a passage and small round exit hole in the gall. *Blue* or *green galls* are those from which the insect has not escaped, and are more esteemed than the *white galls*, which are perforated, and contain less tannin.

Constituents.—*Tannic Acid* (*gallotannic, digallic acid*), about 50 to 60 per cent. of which is present, and *Gallic Acid* (2 or 3 per cent.) are both official (see below). Besides these, *woody matter, glucose, resin,* &c., are present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Tinctura.	No. 40 powder.	1 in 8.	½ to 2 fluid drachms.
Unguentum.	Fine powder.	1 in 5½.	... ...
„ cum Opio.	„	„	... ...

Tannic Acid and *Gallic Acid* are made from galls.

TINCTURA GALLÆ—Tincture of Galls.—*Take of galls, in No.* 40 *powder,* 2½ *ounces ; proof spirit,* 1 *pint. Prepared by maceration and percolation.*

UNGUENTUM GALLÆ—Ointment of Galls.—*Take of galls, in fine powder,* 80 *grains ; benzoated lard,* 1 *ounce. Mix thoroughly.*

UNGUENTUM GALLÆ CUM OPIO—Ointment of Galls and Opium.—*Take of ointment of galls,* 1 *ounce; opium in powder,* 32 *grains. Mix thoroughly.*

Therapeutics.—Galls may be employed for the sake of their astringency in passive internal hæmorrhages, in chronic diarrhœa and dysentery, in profuse chronic mucous discharges, &c. ; they are chiefly used as local astringents in the form of gargle, lotion, wash, or injection; as antidotes, they are employed in poisoning by tartar emetic and the alkaloids. The ointments are employed chiefly as applications to hæmorrhoids.

Acidum Tannicum—Tannic Acid.—An acid, $C_{27}H_{22}O_{17}$, obtained from galls.

Preparation.—*Take of galls in powder, and ether, of each a sufficient quantity. Expose the powdered galls to a damp atmosphere*[1] *for two or three days, and afterwards add sufficient ether to form a soft paste. Let this stand in a well-closed vessel for twenty-four hours, then, having quickly enveloped it in a linen cloth, submit it to strong pressure in a suitable press, so as to separate the liquid portion. Reduce the pressed cake to powder, mix it with sufficient ether, to which one-sixteenth of its bulk of water*[1] *has been added, to form again a soft paste, and press this as before. Mix the expressed liquids, and expose the mixture to sponta-*

neous evaporation until, by the aid subsequently of a little heat, it has acquired the consistence of a soft extract; then place it on earthen plates or dishes, and dry it in a hot-air chamber at a temperature not exceeding 212° F. (100° C.).

[1] The ether removes the tannic acid, leaving the other ingredients of the galls. Pure ether scarcely dissolves tannic acid, but the solution of commercial ether in water consists of ether, alcohol, and water, and is a suitable solvent, as it does not dissolve out other matters from the galls.

Characters and Tests.—In pale yellow vesicular masses or thin glistening scales, with a strongly astringent taste, and an acid reaction; readily soluble in water and rectified spirit, very sparingly soluble in ether. The aqueous solution precipitates solution of gelatine yellowish-white, and the persalts of iron of a bluish-black colour. It leaves no residue when burnt with free access of air.

Dose.—2 to 10 grains.

Chemistry.—*Tannic Acid* (*Gallotannic* or *Digallic Acid*) is most probably a modification of quercotannic acid. It was long considered to be a glucoside, but the glucose present is now held to be an impurity simply. The formula given in the B.P. is not generally accepted, $C_{14}H_{10}O_9$ being regarded by some authorities as more probable. When boiled with dilute mineral acids, or when fungi grow in its watery solution, it splits up into gallic acid, $C_{14}H_{10}O_9+H_2O=2C_7H_6O_5$. It precipitates metallic salts from solution, (striking a blue-black with iron), also alkaloids, albumin, and gelatine. Ferrous salts are said not to give a blue coloration with tannic acid, which is the case if both bodies are absolutely pure, but a purplish or bluish-black colour invariably occurs with ordinary samples owing to the presence of ferric compounds in the ferrous. Its combinations with the alkalis do not precipitate albumin or gelatine. It tans and preserves hides, forming leather.

Official Preparations.

Name.	Strength.	Dose.
Glycerinum.	1 in 6 by weight.	20 to 60 minims.
Suppositoria.	3 grains in each.	... ...
" cum Sapone.	" "	... ...
Trochisci.	$\frac{1}{2}$ grain in each.	1 to 6 lozenges.

GLYCERINUM ACIDI TANNICI — GLYCERINE OF TANNIC ACID.—*Take of tannic acid,* 1 *ounce; glycerine,* 4 *fluid ounces. Stir them together in a porcelain dish, and apply a gentle heat, not exceeding that of the water-bath, until complete solution is effected.*

SUPPOSITORIA ACIDI TANNICI—TANNIC ACID SUPPOSITORIES.—*Take of tannic acid,* 36 *grains; oil of theobroma,* 144 *grains. Rub the tannic acid with* 44 *grains of the oil of theobroma in a slightly warmed mortar, and add them to the rest of the oil of theobroma previously melted. Pour the mixture while it is fluid into suitable moulds of the capacity of* 15 *grains; or the fluid mixture may be allowed to cool, and then be divided into* 12 *equal parts, each of which shall be made into a conical or other convenient form for a suppository.*

SUPPOSITORIA ACIDI TANNICI CUM SAPONE—TANNIC ACID SUPPOSITORIES WITH SOAP.—*Take of tannic acid,* 36 *grains; glycerine of starch,* 50 *grains; curd soap, in powder,* 100 *grains; starch, in powder, a sufficiency. Mix the tannic acid with the glycerine of starch and soap, and add sufficient starch to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository.*

TROCHISCI ACIDI TANNICI—TANNIC ACID LOZENGES.—*Take of tannic acid,* 360 *grains; tincture of tolu,* ½ *fluid ounce; refined sugar, in powder,* 25 *ounces; gum acacia, in powder,* 1 *ounce; mucilage of gum acacia,* 2 *fluid ounces; distilled water,* 1 *fluid ounce. Dissolve the tannic acid in the water; add, first, the tincture of tolu, previously mixed with the mucilage, then the gum and the sugar, also previously well mixed. Form the whole into a proper mass; divide it into* 720 *lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half-a-grain of tannic acid.*

Therapeutics.—Tannic acid acts as a powerful astringent to mucous membranes, forming compounds with their albuminous constituents; as a result a protective antiseptic layer is formed, which contracts the capillaries and the other tissues and diminishes secretion, hyperæmia, and relaxation. It is employed, both internally and externally, to arrest hæmorrhages and chronic discharges, and to astringe relaxed tissues; as in hæmorrhages from the gums, nose, lungs, stomach, bowels, uterus, kidneys; in the night sweats and diarrhœa of phthisis; in chronic bronchial catarrh; in mucous and purulent discharges from the urinary organs, &c. As a topical agent, it is used to check the bleeding of slight wounds, as an application to weak discharging ulcers, as an injection in leucorrhœa, gonorrhœa, and gleet (5 to 10 grains to 1 ounce), as an application in prolapsus ani, hæmorrhoids, fissures of the rectum, &c. Also, as an application to certain discharging skin diseases, to sore nipples, in some affections of the eye, &c. It has been used internally also in albuminuria, but without much success in lessening the discharge.

The local astringent effects of tannic acid are undoubted, but many reliable observers are of opinion that it is of little or no value in checking internal hæmorrhage or mucous discharges. Before absorption from the bowel it is converted into gallate or tannate of sodium or of some other alkali which it meets in the intestinal canal. None of these substances precipitate albumin or exercise an astringent effect, as in them the chemical affinities of tannin are already satisfied. Hence it is unlikely that tannic acid, in the form and amount in which it circulates in the blood, can produce any astringent effect on blood-vessels or mucous membranes. It is excreted in the urine partly as alkaline tannate, partly as gallate, but not by the bronchial mucous membrane or any other channel. A considerable part of it is never absorbed from the bowel.

Adulterations.—Practically, tannic acid is not adulterated.

Acidum Gallicum—Gallic Acid, $H_3C_7H_3O_5 . H_2O$.—An acid prepared from galls.

PREPARATION.—*Boil 1 part of coarsely-powdered galls with 4 fluid parts of diluted sulphuric acid for half an hour, then strain through calico while hot; collect the crystals that are deposited on cooling, and purify these with animal charcoal and repeated crystallisation.*

Characters and Tests.—Crystalline, in acicular prisms or silky needles, sometimes nearly white, but generally of a pale fawn colour. It requires about a hundred parts of cold water for its solution, but dissolves in three parts of boiling water. Soluble also in rectified spirit. The aqueous solution gives no precipitate with solution of isinglass. It gives a bluish-black precipitate with a persalt of iron. The crystalline acid, when dried at 212° F. (100° C.), loses 9·5 per cent. of its weight. It leaves no residue when burned with free access of air.

Dose.—2 to 10 grains or more.

Official Preparation.

Glycerinum, . 1 in 6 by weight. *Dose,* ½ to 1 fluid drachm.

GLYCERINUM ACIDI GALLICI—GLYCERINE OF GALLIC ACID. —*Take of gallic acid, 1 ounce; glycerine, 4 fluid ounces. Stir them together in a porcelain dish, and apply a temperature not exceeding that of a water-bath until complete solution is effected.*

Therapeutics.—Gallic acid is largely used as a remote astringent to control hæmorrhage, night sweats, and mucous discharges. As it does not precipitate albumin it has no local astringent or styptic action, and, according to the most reliable observations, its remote astringent effect is extremely problematical.

Gymnospermæ.

CONIFERÆ or PINACEÆ—The Coniferous or Pine Order.—Resinous trees or shrubs, inhabiting various parts of the world, chiefly met with in the temperate regions of both hemispheres, but found both in cold and warm climates; in the former chiefly as pines, spruces, larches, cedars, and junipers; in the latter as species of Araucaria, Eutassa, and Dammara.

Official Plants.

Name.	Parts Used.	Habitat.
Pinus australis.	Volatile oil and resin.	United States.
,, Tæda.	,, ,,	Southern ,,
,, Pinaster.	,, ,,	S.W. Europe.
,, sylvestris.	,, ,, and volatile oil from leaves; tar from wood.	Northern and Central Europe.
,, balsamea.	Oleo-resin.	United States and Canada.
,, Larix.	Bark.	Central Europe.
,, Picea.	Resinous exudation.	North and Central Europe.
Juniperus Oxycedrus.	Tar from wood.[1]	France and South of Europe.
,, communis.	Volatile oil from fruit.	Indigenous.
,, Sabina.	Fresh and dried tops and volatile oil from them.	,,

[1] These will be considered later.

Pinus australis—Pitch Pine—Yellow Pine—Swamp Pine—Broom Pine (*Pinus palustris*, Mill).

Pinus Tæda—Loblolly—Oldfield Pine—Frankincense Pine.

Pinus Pinaster—Maritime Pine—Cluster Pine—Pinaster (*P. maritima*, Poir).

Pinus sylvestris—Scotch Fir.

Botany—Pinus—Pine.—Generic characters. *Flowers*, monœcious; males, catkins racemose; females, catkins solitary, or from two to three. *Ovaries*, two. Scales of the cone hard, woody, and truncated, hollowed at the base for the reception of the seeds. *Seeds*, in pairs, covered with a sharp pointed membrane. *Leaves*, two or many in the same sheath, evergreen.

Oleum Terebinthinæ—*Oil of Turpentine—Spirit of Turpentine.*—The oil distilled usually by aid of steam from the oleo-resin (turpentine) obtained from *Pinus australis*, Mich.; *P. Tæda*, Linn.; and sometimes from *P. Pinaster*, Solander, and *P. sylvestris*, Linn.; rectified if necessary.

Characters.—Limpid, colourless, with a strong, peculiar odour, which varies in the different kinds, and pungent and bitter taste. It commences to boil at about 320° F. (160° C.) and almost entirely distils below 356° F. (180° C.), little or no residue remaining.

Dose.—10 to 20 minims as a stimulant, diuretic, and expectorant; 2 to 4 fluid drachms as an anthelmintic.

Collection, Composition, &c.—Turpentine is obtained chiefly in America, but largely in France, Russia, &c. The trees are tapped in winter at their lower parts, and the turpentine, which flows out, is collected in vessels or holes cut in the tree. It is an oleo-resin, honey-like and viscid, and consists of *Resin* and the *Volatile Oil of Turpentine.* The volatile oil is separated by distillation either with or without steam, and consists of hydrocarbons $C_{10}H_{16}$, and oxidised products of these. On exposure to the air it absorbs oxygen, and becomes thick and resinous; it is very slightly soluble in water, soluble freely in absolute alcohol, in rectified spirit (1 in 6½), in ether, chloroform, and glacial acetic acid (1 in 3). Its specific gravity varies from ·860 to ·880 about, and it is sometimes dextrogyre, sometimes levogyre. When old and thick it contains ozone.

Resin is the substance left after the volatile oil has been distilled off. It consists chiefly of the *Anhydride of Abietic Acid*, $C_{44}H_{62}O_4$, which, by shaking with warm dilute alcohol, is converted into *Abietic Acid*, $C_{44}H_{64}O_5$. It yields 80 to 90 per cent. of the latter. When it contains some water, it is known as *Yellow Resin*, when quite dried it forms *Transparent Resin*, and, when blackened by heat, *Black Resin.*

Official Preparations of Turpentine.

Name.	Strength.	Dose.
Confectio.	1 in 4	60 to 120 grains.
Enema.	1 in 16	... ...
Linimentum.	16 in 21	... ...
,, Aceticum.	1 in $2\frac{1}{4}$	... ...
Unguentum.	1 in 2 about.	... ...

CONFECTIO TEREBINTHINÆ—CONFECTION OF TURPENTINE.—*Take of oil of turpentine,* 1 *fluid ounce; liquorice root, in powder,* 1 *ounce; clarified honey,* 2 *ounces. Rub the oil of turpentine with the liquorice, add the honey, and mix to a uniform consistence.*

ENEMA TEREBINTHINÆ—ENEMA OF TURPENTINE.—*Take of oil of turpentine,* 1 *fluid ounce; mucilage of starch,* 15 *fluid ounces. Mix.*

LINIMENTUM TEREBINTHINÆ—LINIMENT OF TURPENTINE.—*Take of soft soap,* 2 *ounces; distilled water,* 2 *fluid ounces; camphor,* 1 *ounce; oil of turpentine,* 16 *fluid ounces. Mix the soap with the water, dissolve the camphor in the oil of turpentine, then rub them together until they are thoroughly mixed.*

LINIMENTUM TEREBINTHINÆ ACETICUM—LINIMENT OF TURPENTINE AND ACETIC ACID.—*Take of oil of turpentine,* 4 *fluid ounces; acetic acid,* 1 *ounce; liniment of camphor,* 4 *fluid ounces. Mix.*

UNGUENTUM TEREBINTHINÆ—OINTMENT OF TURPENTINE.—*Take of oil of turpentine,* 1 *fluid ounce; resin, in coarse powder,* 54 *grains; yellow wax; prepared lard; of each* $\frac{1}{2}$ *an ounce. Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools.*

RESINA—*Resin—Colophony.*—The residue left after the distillation of the oil of turpentine from the crude oleo-resin (turpentine) of various species of *Pinus,* Linn.

Characters.—Translucent, yellowish, brittle, pulverisable; fracture shining; odour and taste faintly terebinthinate. It is easily fusible, and burns with a dense yellow flame and much smoke.

Official Preparations.

Emplastrum, ...	1 in $9\frac{1}{2}$
Unguentum, ...	1 in $3\frac{3}{4}$

Also contained in *Charta Epispastica* (1 in $20\frac{3}{8}$); *Emplastrum Calc-*

faciens—Cantharidis (1 in 9½),—*Picis* (1 in 12 nearly),—*Plumbi Iodidi* (1 in 10),—*Saponis* (1 in 43) ; *Unguentum Terebinthinæ* (1 in 17).

EMPLASTRUM RESINÆ—RESIN PLASTER—Adhesive Plaster. —*Take of resin,* 4 *ounces; lead plaster,* 2 *pounds; curd soap,* 2 *ounces. To the lead plaster, previously melted with a gentle heat, add the resin and soap, first liquefied, and stir them until they are thoroughly mixed.*

UNGUENTUM RESINÆ — OINTMENT OF RESIN. — *Take of resin, in coarse powder,* 8 *ounces ; yellow wax,* 4 *ounces; simple ointment,* 16 *ounces; almond oil,* 2 *fluid ounces. Melt with a gentle heat, strain the mixture while hot through flannel, and stir constantly while it cools.*

Therapeutics.—Turpentine acts in small doses as a stimulant, diuretic, diaphoretic, astringent, and antispasmodic ; in larger doses as an anthelmintic and purgative. Externally it acts as a rubefacient and counter-irritant. It communicates an odour of violets to the urine. It occasionally produces nausea, vertigo, feverish restlessness, a kind of intoxication, delirium, coma, hæmaturia, strangury, or a cutaneous eruption, one or more of which symptoms are produced in some persons by turpentine in any form ; untoward results may follow the use of turpentine even when given in medium doses, and it has proved fatal in several cases, but to produce this result the dose requires to be very large. Turpentine has been employed internally in a variety of cases, the chief object of its administration being to arrest passive hæmorrhages and chronic mucous discharges, to act as a diuretic, or anthelmintic, &c. It is given with advantage in chronic bronchitis with copious and fœtid expectoration, in abscess and gangrene of the lungs. As a hæmostatic in hæmoptysis unaccompanied by fever, in hæmaturia and purpura hæmorrhagica, in chronic cystitis and gleet, to check excessive secretion from the mucous membrane of the bladder and urethra, in sciatica, neuralgia, &c. It is apt to cause disagreeable eructations, and may be given floating on water or made into an emulsion with mucilage. Externally it is employed as a rubefacient and counter-irritant ; it may be applied in the form of one of the liniments, or by dipping flannel into hot water, wringing it, sprinkling the surface with oil of turpentine, and then applying it as hot as the patient can bear it. It is also used as the official enema, or mixed with warm water, or soap and water, to unload the bowel or get rid of flatulent distension.

Resin is used locally as a mild stimulant, but chiefly as a basis for plasters.

Terebenum—Terebene. Pure Terebene. (*Not official.*)

PREPARATION.—*From oil of turpentine by treatment with sulphuric acid until it is optically inactive to polarised light, followed by distillation in a current of steam.*

It is a clear fluid, pleasanter than oil of turpentine, and is used chiefly in bronchitis.

Dose.—5 to 10 minims.

THUS AMERICANUM — *Common Frankincense — Gum Thus.* — The concrete turpentine, which is scraped off the trunks of *Pinus australis* and *P. Tæda.*

Characters.—When fresh it is a softish, yellow, opaque, tough solid, with the same odour as crude American turpentine, but by keeping it becomes dry and brittle, darker in colour, and of a milder odour.

It is sometimes called *scrape* from the method of collecting it, and corresponds to the *galipot* of French commerce.

Composition.—It contains a little *volatile oil of turpentine* and *resin* (see turpentine). Used in making *Emplastrum Picis* (1 in 4 about), and its action is the same as that of resin.

Pinus balsamea—Balm of Gilead Fir—Balsam Fir.

TEREBINTHINA CANADENSIS—*Canada Turpentine—Canada Balsam.* —The turpentine obtained by puncturing or incising the bark of the trunk and branches of *Pinus balsamea*, Linn. (*Abies balsamea*, Niell).

Characters.—A pale-yellow, faintly greenish, ductile oleo-resin, of the consistence of thin honey, with a peculiar agreeable odour, and a slightly bitter, feebly acrid taste; by exposure drying very slowly into a transparent adhesive varnish; solidifying when mixed with a sixth of its weight of magnesia.

Dose.—20 to 30 grains.

Composition, &c.—It is an *oleo-resin*, not a true balsam. When heated or exposed to the air it loses about $\frac{1}{4}$ of its weight of *volatile oil*, leaving the *resin*. The latter, dissolved in benzol or some other menstruum, is used for mounting microscopic objects. The resin is amorphous, the greater part being soluble in boiling alcohol, the other part insoluble, but soluble in ether.

Contained in *Charta Epispastica* (1 in 62) and *Collodium Flexile* (1 in $25\frac{1}{2}$).

Therapeutics.—It has the stimulant expectorant action of oil of turpentine, but is almost entirely used externally.

Adulterations.—Sometimes resin, dissolved in oil of turpentine and flavoured with some other oil, is substituted.

Pinus Larix—The Larch.

Laricis Cortex—*Larch Bark.*—The bark of *Pinus Larix*, Linn. (*Abies Larix*, Lamb.; *L. europæa*, D.C.). Collected in spring, deprived of its outer rough portion and dried.

Characters.—Larch bark is found in quills, or more generally in flattish pieces. It consists of the inner bark, middle bark, and a variable proportion of the outer bark. The pieces vary in length and thickness, and have a slight astringent taste and a balsamic terebinthinous odour. Its outer surface has a dark-red colour and uneven appearance, caused by the irregular removal of the outer rough portion; the inner surface is smooth, yellowish-white in colour in the larger pieces, and red in the smaller quills. It breaks with a close fracture, and the fractured surface has a deep carmine colour.

Active Principles.—The chief constituents are a little *volatile oil*, *Larch* or *Venice Turpentine* (see below), and a volatile crystalline body, *Larixin* (Larixinic acid), $C_{10}H_{10}O_5$. *Tannin* is also present, in such amount that the bark has been used for tanning.

Official Preparation.

Tinctura, . . 1 in 8. *Dose*, 20 to 30 minims.

TINCTURA LARICIS—Tincture of Larch.—*Take of larch bark, in* No. 40 *powder*, 2½ *ounces; rectified spirit*, 1 *pint. Made by maceration and percolation.*

Therapeutics.—Larch bark has been used in chronic bronchitis to lessen excessive mucous secretion. It has the action of turpentine essentially.

Terebinthina Veneta.—Venice or Larch Turpentine—(*not official*)—is a thick honey-like fluid, with a turpentine odour, and bitter aromatic taste. It hardens in the air with extreme slowness. It is soluble in alcohol and glacial acetic acid, and consists of about 15 per cent. of a *terpene*, $C_{10}H_{16}$, and an amorphous *resin*. It is collected in the Tyrol and Switzerland, and formerly Venice was the market for it, hence the name.

Its medicinal uses are those of other turpentines, but it is never employed in this country except in veterinary medicine. It can hardly be got genuine here, what is sold for it being usually a mixture of resin and oil of turpentine.

Pinus Picea—Spruce Fir. Norway Spruce.

Pix Burgundica—*Burgundy Pitch.*—A resinous exudation from the stem of *Pinus Picea*, Du Roi (*P. abies*, Linn.; *Abies excelsa*, D.C.), the Spruce Fir, melted and strained.

Characters.—Hard and brittle, yet gradually taking the form of the vessel in which it is kept; opaque, varying in colour, but generally dull reddish-brown; of a peculiar, somewhat empyreumatic, perfumed odour, and aromatic taste, without bitterness. Readily soluble in glacial acetic acid.

It is made in Switzerland, the Black Forest, Central Germany, Russia, &c., and probably acquired its name through being brought into commerce by way of Burgundy.

Composition.—It consists of a little *volatile oil*, $C_{10}H_{16}$, and *amorphous resin*, chiefly the *anhydride of Abietic Acid* (see Turpentine).

Official Preparation.

Emplastrum, ... 1 in 2 nearly.

Also contained in *Emplastrum Ferri* (1 in $5\frac{1}{2}$).

EMPLASTRUM PICIS—Pitch Plaster.—*Take of Burgundy pitch*, 26 *ounces; common frankincense*, 13 *ounces; resin and yellow wax, of each* $4\frac{1}{2}$ *ounces; expressed oil of nutmeg*, 1 *ounce; olive oil and water, of each* 2 *fluid ounces. Add the oils and the water to the frankincense, Burgundy pitch, resin, and wax, previously melted together; then, constantly stirring, evaporate to a proper consistence.*

Therapeutics.—Pitch is used only externally, as a stimulant and somewhat irritant application to the chest in chronic pulmonary complaints; to the loins in lumbago, in local neuralgic pains, and as a support in the form of pitch plaster.

Adulterations.—It is much adulterated, and often consists of resin, mixed with palm oil or some other fat. Such mixtures are not soluble in glacial acetic acid.

Pinus sylvestris—The Scotch Fir.

Oleum Pini Sylvestris—*Fir-wool Oil.*—The oil distilled from the fresh leaves of *Pinus sylvestris.*

Characters and Tests.—Colourless, or nearly so, with an aromatic lavender-like odour, and a pungent, but not unpleasant, flavour. Specific gravity not below 0·870. Soluble in about seven times its volume of rectified spirit.

Dose.—1 to 10 minims.

Chemistry.—It contains *Cymene*, $C_{10}H_{14}$, two other *terpenes*, and resinified products of these.

Official Preparation.

Vapor.

VAPOR OLEI PINI SYLVESTRIS—Inhalation of Fir-wool Oil.—*Take of fir-wool oil*, 40 *minims; light carbonate of magnesium*, 20 *grains; water, a sufficiency. Rub the fir-wool oil with the car-*

bonate of magnesium, and gradually add sufficient water to produce 1 *fluid ounce. Put* 1 *fluid drachm of this mixture with* ½ *pint of cold and* ½ *pint boiling water into an inhaler.*

Therapeutics.—It has the action of oil of turpentine, but is more agreeable. It is used in catarrh of the respiratory passages by the stomach, by inhalation, or by spray.

Juniperus communis—Common Juniper.

Botany.—A bushy shrub. *Leaves*, evergreen, numerous, three in each whorl, linear-subulate, keeled. *Flowers*, diœcious, axillary, sessile. *Fruit*, a purplish-black berry, which ripens in the autumn of the second year. *Habitat*, northern parts of Europe, Asia, and America.

OLEUM JUNIPERI—*Oil of Juniper.*—The oil distilled in Britain from the full-grown unripe green fruit[1] of *Juniperus communis*, Linn.

Characters.—Colourless or pale greenish-yellow, with the characteristic odour of the fruit, and a warm aromatic taste.

Dose.—1 to 4 minims.

[1] The fruit contains 1 or 2 per cent. of volatile oil. It is most abundant when the fruit is green, as it tends to resinify later on.

Chemistry.—It consists of *terpenes* having the composition $C_{10}H_{16}$, or polymers of this, older specimens containing also resinified products. It is levogyrate, and the specific gravity is about 0·87.

Official Preparation.

Spiritus, . . 1 in 50. *Dose*, ½ to 1 fluid drachm.

SPIRITUS JUNIPERI.—*Take of oil of juniper,* 1 *fluid ounce; rectified spirit,* 49 *fluid ounces. Dissolve.*

Therapeutics.—Juniper oil possesses marked carminative and stimulant properties. It acts as a stimulating diuretic, and the spirit is usually employed as an adjunct to mixtures of that class, but the oil may be given in pill, or along with other diuretics in dropsy from cardiac or hepatic disease; in renal dropsy it must be employed with caution, and not in acute cases, as it irritates the kidneys. In large doses it causes a good deal of irritation of the genito-urinary passages, and imparts an odour of violets to the urine. Gin owes its peculiar flavour and reputed strongly-diuretic qualities to oil of juniper, but it contains a small amount only.

Substitutes.—Volatile oil from juniper tops and wood is sometimes used as a substitute or adulterant. It is much cheaper, coarser, and resembles closely oil of turpentine.

Juniperus Sabina—Savin.

Botany.—A small bushy shrub. *Leaves*, small, ovate, densely imbricated, opposite, glandular. *Fruit*, round, bluish-purple, about the size of a currant. *Habitat*, middle and south of Europe, Siberia, Canada.

SABINÆ CACUMINA—*Savin Tops.*—The fresh and dried tops of *Juniperus Sabina*, Linn. Collected in Spring from plants cultivated in Britain.

Characters.—Twigs densely covered with minute imbricated apressed dark-green leaves in four rows, with a large oval depressed central gland on their back; odour strong, peculiar, and unpleasant; taste acrid, bitter, resinous, and disagreeable. The dried tops are yellowish-green.

Dose.—4 to 10 grains.

Composition.—The chief constituent is the *volatile oil* (about 2 per cent.), consisting mostly of a *terpene*, $C_{10}H_{16}$. *Resin*, *tannin*, &c., are also present. The oil has a specific gravity of about 0·91 and is not very readily soluble in alcohol.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Oleum.	Fresh tops, coarse powder.	...	1 to 4 minims.
Tinctura.	Dried tops. coarse powder.	1 in 8.	20 to 60 minims.
Unguentum.	Fresh tops, bruised.	1 in $3\frac{3}{8}$.	... ...

OLEUM SABINÆ—OIL OF SAVIN.—The oil distilled in Britain from the fresh tops of *Juniperus Sabina.*

Characters.—Colourless or pale-yellow, with the odour of the plant, and a bitterish acrid taste.

TINCTURA SABINÆ—TINCTURE OF SAVIN.—*Take of savin tops, dried and coarsely powdered,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Made by maceration and percolation.*

UNGUENTUM SABINÆ—OINTMENT OF SAVIN.—*Take of fresh savin tops, bruised,* 8 *ounces; yellow wax,* 3 *ounces; prepared lard,* 16 *ounces. Melt the lard and the wax together on a water-bath, add the savin, and digest for twenty minutes. Then remove the mixture, and xpress through calico.*

Therapeutics.—Savin in small doses is stimulant and carminative, but is somewhat more acrid than most volatile oils. In over-doses it acts as a powerful local irritant, causing vomiting, purging, and severe pain in the stomach and intestines, with inflammation of the parts. Externally the oil acts as a rubefacient and vesicant. In poisoning by savin the indications are to allay pain by opiates and to soothe the parts by demulcents. Savin is occasionally used with the criminal intention of procuring abortion, a practice which is dangerous, and may occasion the death of the mother by producing severe inflammation. Medicinally, it is not much given internally, but may be employed as an emmenagogue in some cases of amenorrhœa; as it acts by stimulating the uterus, it is contra-indicated in irritable and inflammatory states of that organ or of the adjoining viscera. The ointment acts as a topical irritant, and is chiefly used as an application to setons and blisters, for the purpose of maintaining a sore. Equal parts of savin and verdigris in powder, or of savin and alum in powder, have been used as applications to venereal warts.

Callitris quadrivalvis, Vent. (*Thuja articulata*, Desfont).—A large tree growing in Southern Africa.

It furnishes a resin, *Sandarach*, occurring in pale-yellow tears, covered with a fine dust, with vitreous fracture, and transparent; odour feeble. Insoluble in water, slightly in ether, freely in alcohol. Formerly it had some reputation as a hæmostatic, now it is only used as a varnish.

CLASS II.—MONOCOTYLEDONES, ENDOGENÆ, OR AMPHIBRYA.

SUB-CLASS I.—DICTYOGENÆ.

Nat. Ord. **SMILACEÆ**—The Sarsaparilla Order.—Herbs or shrubby plants, often climbing, natives of temperate and tropical regions. The plants possess demulcent, diuretic, and alterative properties.

Official Plant.

Name.	Part Used.	Habitat.
SMILAX OFFICINALIS	Dried root.	Central and Tropical America.

Smilax officinalis—Sarsaparilla.

SARSÆ RADIX—*Jamaica Sarsaparilla.*—The dried root of *Smilax officinalis*, Kunth. It is commonly known as Jamaica Sarsaparilla, from having been formerly obtained from Central America by way of that island.

Characters.—Roots about thickness of a goose quill, more or less furrowed, greyish-brown to deep reddish-brown, with numerous branched rootlets; 6 feet or more in length, and put up in bundles about $1\frac{1}{2}$ feet long and 4 or 5 inches diameter, the whole bound together by a long root. No smell; taste mucilaginous, feebly bitter and faintly acrid when chewed.

Dose.—30 to 120 grains.

The fibrous roots of the plant often bear a portion of the root-stock, or subterranean tuberous stem, called by druggists the "chump." The rhizome is a solid mass, presenting no distinct division into bark, wood, and pith. The true root-fibres receive a variety of names, according to their condition: when old, dry and withered, they are called *lean;* when plump and fully swelled out, they are called *gouty;* when they are well filled with starch, they are called *mealy;* when the fibres give off numerous little fibrillæ, they are said to be *bearded.* The sarsaparilla of commerce is distinguished by the names of the countries by which it is furnished; thus it is known as Mexican, Guatemala, Honduras, Costa Rica, Lima, Columbian, Brazilian, Peruvian, Caraccas, Vera Cruz, Jamaica. These different kinds are recognised chiefly by slight differences in their external appearances, especially by the manner in which the bundles are constructed. The Jamaica variety is one of the most esteemed, and bears the official characters.

Active Principles.—It contains *Parillin* (*Smilacin, Parillic Acid*), a glucoside closely allied to saponin, but which has not had its formula determined; it is almost insoluble in cold water, soluble in hot water, and in dilute alcohol. A trace of *volatile oil, resin, calcium oxalate,* and other salts, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Decoctum.	Dried Root, cut transversely.	1 to 8.	2 to 10 fluid ounces.
,, Compositum.	,, ,,	,,	,, ,,
Extractum Liquidum.	Dried Root, in No. 40 powder.	1 in 1.	2 to 4 fluid drachms.

DECOCTUM SARSÆ—DECOCTION OF SARSAPARILLA.—*Take of Jamaica sarsaparilla, cut transversely,* $2\frac{1}{2}$ *ounces; boiling distilled water,* $1\frac{1}{2}$ *pint. Digest the sarsaparilla in the water for an hour, then boil for ten minutes in a covered vessel, cool, and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.*

DECOCTUM SARSÆ COMPOSITUM—COMPOUND DECOCTION OF SARSAPARILLA.—*Take of Jamaica sarsaparilla, cut transversely,* $2\frac{1}{2}$ *ounces; sassafras root, in chips, guaiacum wood turnings, and dried liquorice root, bruised, of each* $\frac{1}{4}$ *ounce; mezereon bark,* $\frac{1}{8}$ *ounce; boiling distilled water,* $1\frac{1}{2}$ *pint. Digest the solid ingredients in the water for an hour, then boil for ten minutes in a covered vessel; cool and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.*

EXTRACTUM SARSÆ LIQUIDUM—LIQUOR SARSÆ—LIQUID EXTRACT OF SARSAPARILLA.—*Take of Jamaica sarsaparilla, in No.* 40 *powder,* 40 *ounces; proof spirit,* 2 *pints; sugar,* 5 *ounces; distilled water,* 12 *pints. Mix the sarsaparilla with the spirit, and macerate in a closed vessel for ten days; then press out* 20 *fluid ounces of liquid and set this aside. Mix the pressed residue with the water, and macerate at* 160° *F.* (71°·1 *C.*) *for sixteen hours, then strain and press out the liquid, dissolve the sugar in this, and evaporate in a water-bath to about* 18 *fluid ounces. Mix the two liquids, and make up the volume to* 40 *fluid ounces by the addition of distilled water.*

Therapeutics.—There has been, as yet, but little explanation given of the physiological action of sarsaparilla; it acts as an alterative, diaphoretic, and tonic. In over-doses the powdered root and parillin produce nausea, vomiting, and derangement of the digestive organs. The kinds which contain a good deal of starch act as demulcents. Perhaps there is no drug about whose medicinal value so great a diversity of opinion exists as sarsaparilla. It is chiefly employed in the treatment of inveterate venereal diseases, especially in those cases in which the patient's constitution is broken down, and the characteristic cachexia is well marked, and in which a too liberal use of mercury has added to the unhappy state of the patient. Its influence seems to be exercised upon the general cachectic condition of the patient, restoring his appetite and increasing his weight, rather than as a specific upon the disease itself. It does not prevent secondary symptoms when given early.

In syphilis, chronic rheumatism, and skin affections it is generally given in combination with other remedies. Formerly very large amounts of watery preparations were given, and the combination of drug and fluid had diaphoretic and diuretic actions, besides an influence in increasing general body metabolism. Its alterative action given in this way was no doubt considerable, but it is doubtful if, when given in the moderate pharmacopœial dose, it can exercise any beneficial effect.

Substitutes.—Many species of *Smilax* furnish roots which only differ slightly from the official.

Sub-Class II.—Petaloideæ, or Floridæ.

Nat. Ord. **ZINGIBERACEÆ**—The Ginger Order. — Herbs, nearly all tropical, abounding in the East Indies. The plants possess aromatic and stimulant properties.

Official Plants.

Name.	Part Used.	Habitat.
Zingiber officinale.	Rhizome, scraped and dried.	West and East Indies, &c.
Curcuma longa.	Rhizome.	Southern Asia.
Elettaria Cardamomum.	Seeds.	Malabar and India generally.

Zingiber officinale—Ginger.

Zingiber—*Ginger.*—The scraped and dried rhizome of *Zingiber officinale*, Roscoe (*Amomum Zingiber*, Linn.).

Characters.—In flattish, irregularly branched pieces, 3 or 4 inches long, each branch marked at its summit by a depressed scar ;[1] externally pale-buff, and somewhat striated and fibrous ; breaking readily with a short, mealy, rather fibrous fracture. Odour agreeable, aromatic ; taste strong and pungent.

Dose.—2 to 20 grains.

In commerce, ginger is found *coated* and *uncoated*, the latter having had the outer layer of bark scraped off ; it is then washed and dried in the sun. Dark specimens[2] are sometimes artificially bleached with chlorinated lime or sulphur fumes, or coated with powdered carbonate or sulphate of lime, when they acquire a chalky-white hue. *Preserved ginger* is the young fresh ginger preserved in syrup ; it is quite soft, and yellowish-brown.

1 This shows where a leafy stem has been attached. 2 The ter-

minal part of the rhizome is always soft and mealy, the older portion is fibrous, often dark and resinous, and it is this part which is often of poor quality.

Active Principles.—It contains about 1 per cent. of a yellow *volatile oil*, to which the odour is due, but not the pungency; the pungent substance has been called *Gingerol*, a viscid, odourless, yellow liquid. *Resin*, *starch* (20 per cent.), *mucilage*, &c., are also present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Syrupus.	Strong Tincture.	1 in $4\frac{1}{6}$.	1 fluid drachm.
Tinctura.	Ginger in coarse powder.	1 in 8.	15 minims to 1 fluid drachm.
„ fortior.	Ginger in fine powder.	1 in 2.	5 to 20 minims.

Also contained in *Confectio Opii* (1 in 2 nearly),—*Scammonii* (1 in 6 nearly); *Infusum Sennæ* (1 in 176); *Pilula Scillæ Composita* (1 in $6\frac{1}{4}$ nearly); *Pulvis Cinnamomi Compositus* (1 in 3),—*Jalapæ Compositus* (1 in 15),—*Opii Compositus* (1 in 3),—*Rhei Compositus* (1 in 9),—*Scammonii Compositus* (1 in 8); *Vinum Aloes* (1 in 106 about).

SYRUPUS ZINGIBERIS—Syrup of Ginger.—*Take of strong tincture of ginger*, 6 *fluid drachms; syrup*, 19 *fluid ounces. Mix, with agitation.*

TINCTURA ZINGIBERIS—Tincture of Ginger.—*Take of ginger, in coarse powder*, $2\frac{1}{2}$ *ounces; rectified spirit*, 1 *pint. Made by maceration and percolation.*

TINCTURA ZINGIBERIS FORTIOR—Strong Tincture of Ginger—Essence of Ginger.—*Take of ginger, in fine powder*, 10 *ounces; rectified spirit, a sufficiency. Pack the ginger tightly in a percolator, and pour over it carefully half-a-pint of the spirit. At the expiration of two hours add more spirit, and let it percolate slowly until* 1 *pint of the tincture has been collected.*

It is contained also in *Acidum Sulphuricum Aromaticum* (1 in 23) and *Pilula Scammonii Composita* (1 in 6).

Therapeutics.—Ginger acts as an aromatic stimulant, carminative, and stomachic, and is chiefly used as a corrective adjunct to obviate the nausea and griping of certain purgatives, and as a stimulant in atonic dyspepsia with flatulence. It is also occasionally used as a masticatory. Externally it acts as an irritant and rubefacient.

Curcuma longa.—Turmeric.

TURMERIC.—The dried rhizome of *Curcuma longa*, Linn. (*Amomum Curcuma*, Jacq.; *C. rotunda*, Linn.). In the Appendix, B.P.

Characters.—Round turmeric is in oval or oblong pieces, 1 to 2 inches long, and about half as thick; long turmeric is in cylindrical pieces, about ½ an inch thick, and 2 or 3 inches in length. They are derived from the same plant, the former being the central rhizome or root-stock, and the latter the secondary rhizomes. Externally yellowish-grey, internally orange-yellow or brown-yellow; the cortical layer about half the thickness of the central cylinder; fracture flattish and resinous; odour slight, like ginger; taste warm, aromatic and bitterish. The powder is a deep yellow, turned brown-red by alkalis, and orange by boric acid.

Various kinds are known in commerce—Chinese, Bengal, Madras, Java, &c.—all of which differ in external characters somewhat.

Composition.—It contains about 1 per cent. of *volatile oil*, a *pungent resin*, an aromatic body called *Turmerol*, and *Curcumin*, $C_{14}H_{14}O_4$, in yellow crystals, insoluble in water, very soluble in alkalis, soluble in alcohol and ether. It is this last body which gives the colour reaction with alkalis. *Starch*, *mucilage*, &c.

TURMERIC PAPER.—*Unsized white paper steeped in tincture of turmeric, and dried by exposure to the air.*

TURMERIC TINCTURE.—*Take of turmeric, bruised,* 1 *ounce; proof spirit,* 6 *fluid ounces. Macerate for seven days, and filter.*

Turmeric is present in the Appendix, B.P., as a test for alkalis and boric acid. It is chiefly employed as a condiment, forming a chief constituent of curry powder, to which it gives the yellow colour; its action in this respect is similar to that of ginger, but it is milder. It is also used in dyeing fabrics yellow.

Elettaria Cardamomum—Cardamom—Malabar Cardamom.

CARDAMOMI SEMINA—*Cardamoms.*—The dried ripe seeds of the Malabar Cardamom, *Elettaria Cardamomum,* Maton. — The seeds are best kept in their pericarps, in which condition they are imported; but when required for use they should be separated, and the pericarps rejected.

Characters.—About ⅛ inch long, irregularly angular, transversely wrinkled, dark reddish-brown externally, whitish within; odour and taste agreeably warm and aromatic. The pericarps in which they are enclosed vary from about ⅗ inch to nearly 1 inch long, and from about $\frac{1}{5}$ to $\frac{2}{5}$ inch broad; they are ovoid or oblong, obtusely triangular, shortly beaked, rounded at the base, brownish-yellow, longitudinally striated, and without taste or odour.

Dose.—5 to 15 grains.

The plant is perennial, about 6 to 12 feet high, and grows wild in the Indian forests, but is cultivated for commercial purposes. The fruit begins to ripen in October, and the gathering continues for 2 or 3 months. The fruits should be gathered as they ripen individually, a procedure which is often neglected, the whole being plucked at once and dried, greatly to their detriment in quality. They are valued according to the weight of seeds which they contain (about $\frac{3}{4}$ in good samples), as well as to their sound and mature condition.

There are a great many varieties, such as Madras, Aleppy, Ceylon, Bengal, Java, &c., many of them derived from different species, but all having essentially the same medicinal properties. It would require too much space to describe these in detail, and, further, only the Malabar variety is official.

Active Principles.—The seeds contain about 10 per cent. of *fixed oil*, and 4 or 5 per cent. *volatile oil*, *albumin*, *starch*, and a large amount of *salts*.

Official Preparation.

Tinctura Composita, . . 1 in 40. *Dose*, $\frac{1}{2}$ to 2 fluid drachms.

Also contained in *Extractum Colocynthidis Compositum* (1 in 27 nearly); *Pulvis Cinnamomi Compositus* (1 in 3),—*Cretæ Aromaticus* (1 in 44); *Tinctura Gentianæ Composita* (1 in 80),—*Rhei* (1 in 80); *Vinum Aloes.*

TINCTURA CARDAMOMI COMPOSITA—COMPOUND TINCTURE OF CARDAMOMS.—*Take of cardamom seeds, freed from the pericarps and bruised,* $\frac{1}{4}$ *ounce; caraway fruit, bruised,* $\frac{1}{4}$ *ounce; raisins, freed from their seeds,* 2 *ounces; cinnamon bark, bruised,* $\frac{1}{2}$ *ounce; cochineal, in powder,* 55 *grains; proof spirit,* 1 *pint. Made by maceration and percolation.*

Therapeutics.—Cardamoms act as an aromatic carminative stimulant, and are used as a stomachic or corrective adjunct to other medicines.

Amomum Melegueta—(*non-official*).—The seeds are known as *Grains of Paradise, Guinea grains, Melegueta pepper.* The plant grows in West Africa, the fruit is about 3 inches long, bright-red, and contains numerous seeds imbedded in a colourless pulp. These seeds are about $\frac{1}{12}$ to $\frac{1}{8}$ inch long, slightly pointed at one end, testa reddish-brown, slightly warty, albumin whitish and oily; odour somewhat spicy, taste pungent and pepper-like.

They contain *volatile oil* (about $\frac{1}{3}$ per cent.), *resin*, *starch*, *fat*, *tannin*, &c., as well as a pungent viscid substance, which has been called *Paridol*, $C_9H_{14}O_2$.

They are used as a spice in Africa, and here chiefly in cattle medicines, and to give a pungent taste to cordials.

Nat. Ord. **MARANTACEÆ or CANNACEÆ**—The Arrow-root Order.—Herbaceous plants, closely allied to the Zingiberaceæ, natives of the tropical parts of America, Africa, and Asia. The plants yield starch.

Maranta arundinacea — Arrow-root — (*not official*).— *Habitat*, West Indies and South America.

The plant is an herbaceous perennial; the fecula of its tubers constitutes the arrow-root[1] of commerce. It is obtained by beating the tubers into a pulp, washing out the starchy matter with water, separating it from the fibrous tissue by straining, and collecting it by subsidence. It is then dried in the sun, and forms the white, tasteless, inodorous, granular substance known as arrow-root, which is a pure form of starch. There are many kinds of arrow-root, known either by the names of the countries whence they are imported, or by the names of the plants producing them, and the name has really become a generic term for starches of this kind. *Maranta*, or *West Indian Arrow-root*, is the most esteemed variety; and it is liable to adulteration with inferior kinds. Arrow-root is used as a mild non-stimulating article of diet, suitable for invalids and children. Several species of *Canna* furnish starchy substances, one of which, produced in the West Indies, is known as *Tous-les-mois*.

[1] The word is said to be derived from ara-ruta, two Indian words meaning meal-root.

Nat. Ord. **ORCHIDACEÆ**—The Orchid Order.—Distinguished by the peculiar forms of their flowers. Some are mucilaginous, others fragrant.

Vanilla planifolia—The Vanilla—(*not official*).—It is a climbing plant indigenous to Mexico, but grown in Madagascar, Mauritius, and many other places. The fruit is a pod 5 to 10 inches long; it is gathered before quite ripe, and when dried constitutes *Vanilla*. The colour and peculiar aroma of vanilla develop during the drying and sweating.

Characters.—From 5 to 10 inches long, linear, obscurely triangular, bent or hooked at the base, rather oblique at the apex; wrinkled, somewhat warty, dark-brown, glossy, leathery, one-celled, containing a blackish-brown fragrant pulp, with numerous minute black seeds, and more or less acicular crystals.

Dose.—5 to 30 grains.

Mexican vanilla is the finest, but there are many kinds—Venezuela, Bourbon, Brazilian.

Active Constituents.—The fragrance is due to *Vanillin*, $C_8H_8O_3$ ($1\frac{1}{2}$ to 3 per cent. about), which is often found as minute crystals in the fruit, or is dissolved in the pulp. It is the aldehyde of methyl-protocatechuic acid, and can be made artificially from phenol and other bodies. It is in crystals when pure, slightly soluble in water, very soluble in alcohol, ether, fixed and volatile oils. *Fixed oil* (10 per cent. about), *resin*, *sugar*, &c., are present.

It is not used as a medicine, but largely as a flavouring for chocolate and confectionery, and in perfumery. A tincture is official in the U.S.P.

Orchis mascula and other species—(*not official*)—found in Central and Southern Europe, have tubers which constitute *Salep*. They are about 1 inch long, deprived of the epidermis and scalded, brownish-yellow, hard, inodorous, and insipid. Some of them are palmately divided (*Orchis latifolia*).

The constituents are *starch* (27 per cent. about) and *mucilage* (50 per cent.), with *sugar*, *albumin*, &c. It forms a jelly with water, and is regarded popularly as highly nutritious, but its nutritive value is greatly exaggerated. It is demulcent.

Nat. Ord. **ARACEÆ**—The Arum Order.—Acrid, and some are irritant poisons; some yield starch.

Acorus Calamus—Sweet Flag—Cinnamon Sedge.—*Habitat*, very widely distributed in Europe, Asia, and America, in wet places—(*not official*).

The rhizome is official in the U.S.P. It is about 40 inches long, but is met with cut into smaller pieces, nearly 1 inch broad, sub-cylindrical unpeeled, reddish-brown, wrinkled, and somewhat annulate, on the lower surface marked with the circular scars of the rootlets; internally whitish, spongy, short corky fracture; odour aromatic; taste strongly bitter. It contains *volatile oil* (1 to 2 per cent.), a bitter principle which has been called *Acorin*, *resin*, *starch* &c.

It is used as an aromatic bitter and stimulant in doses up to 1 drachm of the liquid extract.

Nat. Ord. **IRIDACEÆ**—The Iris Order.—Herbs inhabiting temperate and warm parts of the world. The plants possess acrid, purgative, and emetic properties.

Official Plant.

Name.	Part Used.	Habitat.
CROCUS SATIVUS	Dried stigmas & top of style.	Greece, Italy, Levant.

Crocus sativus—Saffron.

CROCUS—*Saffron.*—The dried stigmas and top of the style of *Crocus sativus*, Linn. (*C. officinalis*, Hudson; *C. Orsinii*, Parl.).

Characters and Tests.—Each entire portion of commercial saffron is an inch or somewhat more in length; it consists of three thread-like orange-red stigmas, thickened and tubular above, jagged or notched at their extremities, and united below to the top of the yellow style. Flexible, unctuous to the touch, with a peculiar strong aromatic odour, and a bitter, somewhat aromatic, taste. Wetted and rubbed on the finger it leaves an intense orange-yellow tint. When pressed between folds of white filtering paper, it leaves no oily stain.[1] When a small portion is placed in a glass of warm water, it colours the liquid orange-yellow, but should not deposit any white or coloured powder.[2] Ignited, it yields about 6 per cent. ash.[3]

Dose.—5 to 30 grains.

[1] Detects oil, glycerine, syrup or water added to give it weight and a fresh appearance. [2] Coloured chalk or other mineral matter is thus detected. [3] Not more than usual amount of ash present.

Saffron is now cultivated chiefly in France, Spain, and Italy, but in some other countries to a small extent. The flowers are gathered in September and October, the stigmas and end of the styles removed and quickly dried over a gentle fire. It takes about 8000 flowers to yield $3\frac{1}{2}$ ounces of dried saffron.

Composition.—Saffron contains a colouring matter, *Polychroit* (*Crocin*), $C_{48}H_{60}O_{18}$, insoluble in ether, soluble in water and alcohol. It can be decomposed into *glucose*, a heavy *essential oil*, $C_{10}H_{14}O$, and *Crocetin* (*Crocin*), $C_{16}H_{18}O_6$. Polychroit is an orange-red, amorphous, deliquescent body, without odour, but with a sweetish taste. There is about 1 per cent. *volatile oil*, to which the odour is due, *mucilage*, *starch*, &c.

Official Preparation.

Tinctura, . . 1 in 20. *Dose*, $\frac{1}{2}$ to 2 fluid drachms.

Saffron is also contained in *Decoctum Aloes Compositum; Pilula Aloes et Myrrhæ* (1 in 12) ; *Pulvis Cretæ Aromaticus* (1 in 15 about) ; *Tinctura Cinchonæ Composita,—Opii Ammoniata,—Rhei.*

TINCTURA CROCI—Tincture of Saffron.—*Take of saffron*, 1 *ounce; proof spirit*, 1 *pint. Made by maceration and percolation.*

Therapeutics.—Saffron was formerly held in great esteem as an antispasmodic, stimulant, and emmenagogue. Now it is only used as a colouring and flavouring agent. It is used slightly as a condiment and as a dye-stuff, but is mostly superseded by less costly substances.

Adulterations.—Oil, water, glycerine, syrup, and coloured chalk have been already referred to. Shredded beef has been used, and the florets of Marigold, *Calendula officinalis*, or of Safflower, *Carthamus tinctorius*, or shredded petals of other plants dyed yellow. All these may be detected by floating them in water, when they have not the characteristic form of true saffron.

Iris florentina—Florence Iris—White Flag.—*Habitat*, Southern and Eastern Europe.

The rhizome is used under the name of Orris Root, which in Tuscany is derived indiscriminately from *I. florentina*, *I. germanica*, and *I. pallida*. It is in pieces 2 to 4 inches long, and $\frac{1}{2}$ to $1\frac{1}{4}$ inch broad, which have been peeled and dried ; irregularly conical in shape, shrivelled, and marked on the lower surface by scars left by the cut-off rootlets. Colour dull-whitish ; taste bitterish, faintly aromatic and then acrid ; odour agreeable and like violets. The odour is slowly developed during keeping for about two years.

The constituents are *Oil of Orris*, a volatile oil present in small amount (about $\frac{1}{10}$ per cent.), which consists chiefly of *Myristic Acid*, $C_{14}H_{28}O_2$, mixed with a small quantity of volatile oil. It is solid at ordinary temperatures, and is obtained in crystals floating on the surface when orris root is distilled with water. It has also been named *Orris Camphor*. *Resin, tannin, fat, wax, a bitter substance*, &c., are also present.

It is now almost entirely used in perfumery, in dentifrices, and for similar cosmetic purposes. It is cathartic and diuretic, and on the Continent was formerly given in dropsy in 5 to 15 grain doses.

Iris versicolor—Blue Flag.

The rhizome of this plant, indigenous in North America, is official in the U.S.P. It contains an *acrid resin*, a *camphoraceous body*, *fat*, *tannin*, &c., but its active principles are imperfectly known. The powdered dry extract is known as *Iridin*, and consists chiefly of impure resin. In doses of 1 to 5 grains it is used as a mild purgative in bilious dyspepsia, hepatic derangements, slight jaundice, &c. Larger doses are emetic and cathartic.

Nat. Ord. **LILIACEÆ**—The Lily Order.—Herbs, shrubs, or trees, natives both of temperate and tropical regions. The plants possess purgative, emetic, stimulant, diaphoretic, astringent, and other properties.

Official Plants.

Name.	Part Used.	Habitat.
Aloe vulgaris.	Inspissated juice.	North Africa.
„ Perryi and other species.	„	Socotra.
Urginea Scilla.	Dried bulb.	Mediterranean shores.

Aloe vulgaris—Common Aloe—Barbadoes Aloe.

Aloe Barbadensis—*Barbadoes Aloes.*—The juice when inspissated which flows from the transversely-cut bases of the leaves of *Aloe vulgaris*, Lamarck (*A. Barbadensis*, Miller, &c.). Imported from Barbadoes and the Dutch West Indian Islands, and known in commerce as Barbadoes and Curaçoa Aloes.

Characters and Tests.—Colour from deep reddish-brown to dark-brown or almost black; fracture usually dull and waxy, or sometimes smooth and glassy; opaque in mass, but in thin films translucent and of an orange-brown tint; powder dull olive-yellow. Odour strong and disagreeable; taste bitter and nauseous. The Curaçoa variety is commonly more glassy and translucent than the ordinary Barbadoes kind, and has a distinctive odour. When moistened with rectified spirit and examined in a thin stratum under the microscope, it exhibits numerous crystals. Almost entirely soluble in proof spirit.

Dose.—2 to 6 grains.

Aloe Perryi.—The Socotrine Aloe.

ALOE SOCOTRINA—*Socotrine Aloes.*—The juice, when inspissated, which flows from the transversely cut bases of the leaves of *Aloe Perryi*, Baker, and probably other species. Imported principally by way of Bombay and Zanzibar, and known in commerce as Socotrine and Zanzibar Aloes.

Characters and Tests.—Colour of various shades of reddish-brown, darkening by exposure to the air ; fracture usually smooth and resinous, or rarely rough and irregular ; in thin films transparent orange-ruby-red or orange-brown ; powder bright, tawny reddish-brown ; odour strong and somewhat agreeable ; taste very bitter. When moistened with rectified spirit, and examined in a thin stratum under the microscope, it exhibits numerous crystals. In other cases, Socotrine aloes is more or less opaque and liver-coloured, and is then known as hepatic aloes. Almost entirely soluble in proof spirit.

Dose.—2 to 6 grains.

The leaves are thick and very fleshy. In Barbadoes the plant is carefully cultivated, the leaves are cut off in March or April annually, and the juice allowed to flow out spontaneously. It is at first white, but when inspissated by artificial heat (or sometimes by solar heat) it darkens greatly. When sufficiently evaported the juice is poured into gourds or boxes, and allowed to harden. The plant was introduced into Barbadoes about the beginning of the sixteenth century.

Active Principles.—*Aloin* is the purgative principle. It is official (see below), and exists to the extent of about 60 per cent. in the crude drug. The B.P. states its composition as $C_{16}H_{18}O_7$, but aloin got from different varieties probably differs somewhat in composition. The above is the formula generally assigned to *Socaloin* (from Socotrine aloes), while *Barbaloin* is $C_{17}H_{20}O_7$, and *Nataloin* (from Natal aloes) is $C_{16}H_{18}O_7$. The first is little affected by cold nitric acid, while the other two are coloured crimson by it, and on careful oxidation yield picric and oxalic acids. They differ also in other respects. There is a minute quantity of *volatile oil*, to which the odour is due, *resin*, *salts*, &c.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Aloin.	Both varieties.	... ...	½ to 2 grains.
Enema.	"	40 grains in 10 ounces.	...
Extractum Barbadensis.	Bardadoes Aloes.	... ...	2 to 6 grains.
Pilula Barbadensis.	"	1 in 2 nearly.	5 to 10 "
Pilula et Ferri.	"	1 in 5¼.	5 to 10 "
Decoctum Compositum.	Extract of Socotrine Aloes.	1 in 100.	½ to 2 fluid ounces.
Extractum Socotrinæ.	Socotrine Aloes.	... ...	2 to 6 grains.
Pilula et Asafœtidæ.	"	1 in 4.	5 to 10 "
Pilula et Myrrhæ.	"	1 in 2½.	5 to 10 "
Pilula Socotrinæ.	"	1 in 2 nearly.	5 to 10 "
Tinctura.	"	1 in 40.	1 to 2 fluid drachms.
Vinum.	"	1 in 26 (about).	1 to 2 fluid drachms.

Barbadoes Aloes is also contained in *Pilula Cambogiæ Composita* (1 in 6 nearly)—*Colocynthidis Composita* (1 in 3 nearly)—*Colocynthidis et Hyoscyami* (1 in 4½ nearly). Socotrine Aloes in *Pilula Rhei Composita* (1 in 6), and *Tinctura Benzoini Composita* (8 grains in 1 ounce).

ALOIN—Aloin, $C_{16}H_{18}O_7$.—A crystalline substance extracted from aloes by solvents, and purified by recrystallisation. As obtained from the different varieties of aloes, the products differ slightly, but their medicinal properties are similar.

Characters.—It occurs usually in tufts of acicular crystals, yellow, inodorous, and having the taste of aloes. Sparingly soluble in cold water, more so in cold rectified spirit, freely soluble in the hot fluids. Insoluble in ether. Not readily altered in acidified or neutral solutions; rapidly altered in alkaline fluids.

ENEMA ALOES—ENEMA OF ALOES.—*Take of aloes,* 40 *grains; carbonate of potash,* 15 *grains; mucilage of starch,* 10 *fluid ounces. Mix, and rub together.*

EXTRACTUM ALOES BARBADENSIS—EXTRACT OF BARBADOES ALOES.—*Take of Barbadoes aloes, in small fragments,* 1 *pound; boiling distilled water,* 1 *gallon. Add the aloes to the water, and stir well, until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness.*

PILULA ALOES BARBADENSIS—PILL OF BARBADOES ALOES.—*Take of Barbadoes aloes, in powder,* 2 *ounces; hard soap, in powder,* 1 *ounce; oil of caraway,* 1 *fluid drachm; confection of roses,* 1 *ounce. Beat all together until thoroughly mixed.*

PILULA ALOES ET FERRI—PILL OF ALOES AND IRON.—*Take of sulphate of iron,* 1½ *ounce; Barbadoes aloes, in powder,* 2 *ounces; compound powder of cinnamon,* 3 *ounces; confection of roses,* 4 *ounces. Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and adding the confection, make the whole into a uniform mass.*

DECOCTUM ALOES COMPOSITUM—COMPOUND DECOCTION OF ALOES.—*Take of extract of Socotrine aloes,* ½ *ounce; myrrh, saffron, carbonate of potash, of each* ¼ *ounce; extract of liquorice,* 2 *ounces; compound tincture of cardamoms,* 15 *fluid ounces; distilled water, a sufficiency to make* 50 *fluid ounces. Reduce the extract of aloes and myrrh to coarse powder, and put them, together with the carbonate of potash and extract of liquorice, into a suitable covered vessel with a pint of distilled water; boil gently for five minutes, then add the saffron. Let the vessel with its contents cool, then add the tincture of cardamoms, and, covering the vessel closely, allow the ingredients to macerate for two hours; finally, strain through flannel, pouring as much distilled water over the contents of the strainer as will make the strained product measure* 50 *fluid ounces. Keep in vessels from which air is excluded as far as possible.*

EXTRACTUM ALOES SOCOTRINÆ—EXTRACT OF SOCOTRINE ALOES.—*Take of Socotrine aloes, in small fragments,* 1 *pound; boiling distilled water,* 1 *gallon. Add the aloes to the water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness.*

PILULA ALOES ET ASAFŒTIDÆ—PILL OF ALOES AND ASAFŒTIDA.—*Take of Socotrine aloes, in powder, asafœtida, hard soap, in powder, confection of roses, of each* 1 *ounce. Beat all together until thoroughly mixed.*

PILULA ALOES ET MYRRHÆ—Pill of Aloes and Myrrh. —*Take of Socotrine aloes,* 2 *ounces; myrrh,* 1 *ounce; saffron, dried,* ½ *ounce; treacle,* 1 *ounce; glycerine, a sufficiency. Triturate the aloes, myrrh, and saffron together; then add the treacle and sufficient glycerine, and beat them together into a uniform mass.*

PILULA ALOES SOCOTRINÆ—Pill of Socotrine Aloes.—*Take of Socotrine aloes, in powder,* 2 *ounces; hard soap, in powder,* 1 *ounce; volatile oil of nutmeg,* 1 *fluid drachm; confection of roses,* 1 *ounce. Beat all together until thoroughly mixed.*

TINCTURA ALOES—Tincture of Aloes.—*Take of Socotrine aloes, in coarse powder,* ½ *ounce; extract of liquorice,* 1½ *ounce; proof spirit, a sufficiency. Macerate the aloes and extract of liquorice in* 15 *fluid ounces of the spirit for seven days in a closed vessel, with occasional agitation; then filter, and add sufficient proof spirit to make* 1 *pint.*

VINUM ALOES—Wine of Aloes.—*Take of Socotrine aloes,* 1½ *ounce; cardamom seeds bruised, ginger, in coarse powder, of each* 80 *grains; sherry,* 2 *pints. Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor, and add sufficient sherry to make* 2 *pints.*

Therapeutics.—Aloes acts in small doses as a stomachic tonic, and in larger doses as a tonic cathartic. The purgative action is slow, requiring 12 to 16 hours, and it is the large intestine which is chiefly affected. In some persons it produces severe irritation of the mucous membrane of the rectum, and tenesmus, in which case it should be combined with hyoscyamus. Aloes may be given as a purgative in torpid states of the bowels, but is not suitable when a prompt evacuation is demanded. In habitual constipation, in cases in which the large intestine is apt to become loaded and inactive, in sluggish conditions of the uterine system, in amenorrhœa, &c., an aloetic purge may be given occasionally. It may be combined with advantage with Ipecacuanha, 1 gr., and Ext. Belladonnæ and Nucis Vomicæ, each ¼ gr. Aloes should not be given in inflammatory states of the liver and intestines, nor in acute affections of the rectum or uterine organs, nor in certain hæmorrhoidal cases, and should be employed cautiously during pregnancy. The compound decoction acts as a tonic, antacid, emmenagogue, and mild cathartic; it is a valuable medicine in amenorrhœa and anæmia, and may be combined with chalybeates. The enema acts as a stimulating purgative, and is also employed to remove worms.

Aloe spicata—The Cape Aloe—(*not official*).—*Habitat*—S. Africa. This plant and other species furnish Cape Aloes—*Aloe Capensis.*

In blackish-brown or almost black pieces, with a smooth glassy fracture, and a peculiar sour, disagreeable odour, especially if breathed on. It is very brittle and easily powdered, the powder being tawny yellow. When moistened, no crystals can be detected under the microscope. It is carelessly prepared, and of somewhat inferior quality.

Natal aloes is another variety made in Natal. It is yellowish-brown, dull, and opaque ; odour and taste weaker than in the other varieties. Under the microscope it shows crystals.

Urginea Scilla—Squill.

SCILLA—*Squill.*—The bulb of *Urginea Scilla,* Steinheil (*Scilla maritima,* Linn., &c.), divested of its dry membranous outer scales, cut into slices and dried.

Characters.—Bulb pear-shaped, weighing from ½ pound to 10 pounds ; outer scales membranous, brownish-red or white ; inner scales thick, whitish, fleshy, juicy ; taste mucilaginous, intensely and disagreeably bitter, somewhat acrid. The dried slices are white or yellowish-white, slightly translucent, odourless, disagreeably bitter, brittle, and easily pulverisable if very dry, but if exposed, readily recovering moisture and flexibility.

Dose.—1 to 3 grains.

Active Principles.—Several active substances have been described, but none of them have been obtained in a state of absolute purity, and their exact relationships to each other are unknown. *Scillain* is a glucoside, having the action of digitalis ; *Scillipicrin* is very bitter, soluble in water ; *Scillitoxin* is also bitter and soluble in alcohol ; both act on the heart. *Scillin* has also been isolated. *Mucilage, sugar,* and *calcium oxalate* crystals are present.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Acetum.	Squill, bruised.	1 in 8.	15 to 40 minims.
Oxymel.	Acetum.	1 in $2\frac{3}{5}$.	½ to 1 fluid drachm.
Pilula Ipecacuanhæ cum Scilla.	Squill in powder.	1 in 7.	5 to 10 grains.
Pilula Composita.	" "	1 in 5.	5 to 10 grains.
Syrupus.	Acetum.	...	½ to 1 fluid drachm.
Tinctura.	Squill, bruised.	1 in 8.	10 to 30 minims.

ACETUM SCILLÆ—Vinegar of Squill.—*Take of squill, bruised, 2½ ounces; diluted acetic acid, 1 pint. Macerate the squill in the acetic acid for seven days, then strain with expression and filter. Specific gravity about* 1·038.

OXYMEL SCILLÆ—Oxymel of Squill.—*Take of vinegar of squill, 1 pint; clarified honey, 2 pounds. Mix and evaporate by a water-bath until the product, when cold, shall have a specific gravity of* 1·32.

PILULA IPECACUANHÆ CUM SCILLA—Pill of Ipecacuanha with Squill.—*Take of compound powder of ipecacuanha,* 3 *ounces; squill, in powder,* 1 *ounce; ammoniacum, in powder,* 1 *ounce; treacle, a sufficiency. Mix the powders, and beat into a mass with the treacle.*

PILULA SCILLÆ COMPOSITA—Compound Squill Pill.—*Take of squill, in powder,* 1¼ *ounce; ginger, in powder; ammoniacum, in powder; hard soap, in powder, of each* 1 *ounce; treacle, by weight,* 2 *ounces, or a sufficiency. Mix the powders, add the treacle, and beat into a uniform mass.*

SYRUPUS SCILLÆ—Syrup of Squill.—*Take of vinegar of squill,* 1 *pint; refined sugar,* 2½ *pounds. Dissolve with the aid of heat. Specific gravity about* 1·345.

TINCTURA SCILLÆ—Tincture of Squill.—*Take of squill, bruised,* 2½ *ounces; proof spirit,* 1 *pint. Made by maceration and percolation.*

Therapeutics.—Squill acts in over-doses as a cardiac and muscle poison, producing, in addition, vomiting, purging, severe griping, and irritation of the stomach and bowels; twenty-four grains of the powder have caused death. In full doses, squill acts as an emetic, but is uncertain in its operation. In small medicinal doses it acts as a cardiac tonic, diuretic and expectorant, stimulating the secretions of the kidneys and the broncho-pulmonary mucous membrane; it acts more or less also upon the gastro-intestinal mucous membrane, occasionally operating as a laxative. As a diuretic it is useful in dropsies, more especially if resulting from cardiac disease. As an expectorant it is useful in chronic bronchial pulmonary complaints. In consequence of its irritant qualities, it is contra-indicated in inflammatory conditions of the intestinal canal. In cardiac disease it is generally given combined with digitalis, or with blue pill added to the combination; in bronchitis it is given with other expectorants.

Allium sativum—Garlic—(*not official*).—A perennial herb with a short axis giving off slender fibrous rootlets below, and from the crown thin scales which form a "bulb." *Flowering stem,* terminal, smooth, solid, $1\frac{1}{2}$ to 2 feet high. *Leaves*, 7 or 8 (the scales mentioned above). *Habitat*, Central Asia, cultivated widely. The bulb is sub-globular, compound, consisting of about eight compressed wedge-shaped bulblets, which are arranged in a circle around the base of the stem, and covered by several dry membranaceous scales. It has a pungent, disagreeable odour, and a warm acrid taste.

Dose.—30 to 60 grains as expressed juice.

It contains *mucilage*, *albumen*, and a *volatile oil* (about $\frac{1}{4}$ per cent.), consisting of sulphide of allyl chiefly.

It is used in cookery as a carminative and stimulant. The essential oil confers on it also diuretic and expectorant properties.

Convallaria majalis—Lily of the Valley—(*not official*).—*Habitat*, Europe, Asia, America. It contains two active substances, *Convallamarin*, a white powder, bitter, soluble in water and alcohol, and *Convallarin*, in crystals, soluble in water. Both have the digitalis action.

Dose.—1 to 6 grains.

TINCTURA CONVALLARIÆ — TINCTURE OF LILY OF THE VALLEY, B.P.C.—(*not official*).—*Take of lily of the valley flowers and stalks, dried in No.* 20 *powder*, $2\frac{1}{2}$ *ounces; proof spirit, a sufficient quantity. Moisten the powder with a suitable quantity of the menstrum, and macerate for twenty-four hours; then pack in a percolator, and gradually pour proof spirit on it until* 1 *pint of tincture is obtained.*

Dose.—5 to 20 minims.

It is used as a substitute for digitalis, and is said not to be so cumulative, but its effects are not so lasting.

Nat. Ord. **MELANTHACEÆ or COLCHICACEÆ**—The Colchicum Order.—Herbs, generally distributed over the world, but most abundant in northern countries.

Official Plants.

Name.	Part Used.	Habitat.
COLCHICUM AUTUMNALE.	Corm, fresh and dried, and seeds.	Indigenous.
VERATRUM VIRIDE.	Rhizome.	North America.
SCHŒNOCAULON OFFICINALE.	Dried ripe seeds.	Mexico, Central America.

Colchicum autumnale—Meadow Saffron—Wild Saffron.

Botany.—*Root*, fibrous. *Corm*, ovate, fleshy, covered with a loose brown tegument. *Leaves*, flat, broadly lanceolate, erect, about 12 inches long, dark-green, smooth, appear in spring. *Flowers*, several, lilac or pale-purple, arising from the young corm in autumn, by a long narrow, white tube. *Capsule*, three-celled. *Seeds*, numerous, small, spherical, with a rough brown testa. *Habitat*, moist meadows in this and other European countries.

Colchici Cormus—*Colchicum Corm.*—The fresh corm of *Colchicum autumnale*, Linn., collected about the end of June or beginning of July;[1] and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150° F. (65°·5 C.).

Characters.—Fresh corm about $1\frac{1}{2}$ inch long and 1 inch broad, somewhat conical, flattened on one side where it has a new corm in process of development,[2] and rounded on the other ; covered with an outer thin brown membranous coat, and an inner one reddish-yellow ; internally white and solid, and when cut yielding a milky juice of a bitter taste and disagreeable odour. The dried slices about $\frac{1}{8}$ inch thick, yellowish at their circumference, kidney-shaped ; the surfaces firm, whitish, amylaceous; breaking readily with a short fracture. Taste bitter, no odour.[3]

Dose.—2 to 8 grains.

[1] It is then largest. [2] The new corm is at the lower end of the old one close to its junction with the radicles or root proper. If undisturbed the new corm flowers in the autumn, sends up its leaves in the following spring, and its seeds in June. It then shrivels away. When gathered it is about one year old. [3] During the drying a volatile odorous substance is lost.

Colchici Semina — *Colchicum Seeds.* — The seeds of *Colchicum autumnale*, Linn., collected when fully ripe, which is commonly about the end of July or beginning of August ; carefully dried.

Characters. — About $\frac{1}{10}$ inch in diameter, subglobular, slightly pointed at the hilum, reddish-brown, somewhat rough, very hard and difficult to powder ; no odour, taste bitter and acrid.

Dose.—1 to 8 grains.

Active Principles.—Both contain an alkaloid, *Colchicine*, $C_{22}H_{25}NO_6$ (about $\frac{1}{5}$ per cent. or less), colourless or yellowish, amorphous, soluble in water and alcohol, less soluble in ether. On treatment with acids it yields *Colchicein*, $C_{21}H_{23}NO_6$, of which it is the methyl-ether. This body is soluble in alcohol and hot water, and gives a green colour with ferric chloride. *Resins*, *fat*, *starch*, &c., are present also both in seeds and corm.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum.	Corm.	...	$\frac{1}{8}$ to 2 grains.
„ Aceticum.	Corm.	...	$\frac{1}{2}$ to 2 grains.
Tinctura Seminum.	Seeds comminuted.	1 in 8.	10 to 30 minims.
Vinum.	Corm in No. 20 powder.	1 in 5.	10 to 30 minims.

EXTRACTUM COLCHICI—Extract of Colchicum.—*Take of fresh colchicum corms, deprived of their coats, 7 pounds; crush the corms, press out the juice; allow the feculence to subside, and heat the clear liquid to* 212° *F.* (100° *C.*) ; *then strain through flannel, and evaporate by a water-bath at a temperature not exceeding* 160° *F.* (71°·1 *C.*), *until the extract is of a suitable consistence for forming pills.*

EXTRACTUM COLCHICI ACETICUM—Acetic Extract of Colchicum.—*Take of fresh colchicum corms, deprived of their coats,* 7 *pounds; acetic acid,* 6 *fluid ounces. Crush the corms, add the acetic acid, and press out the juice; allow the feculence to subside, and heat the clear liquor to* 212° *F.* (100° *C.*) ; *then strain through flannel, and evaporate by a water-bath, at a temperature not exceeding* 160 *F.* (71°·1 *C.*) *to the consistency of a soft extract.*

TINCTURA COLCHICI SEMINUM—Tincture of Colchicum Seeds.—*Take of colchicum seeds, finely comminuted,* 2½ *ounces; proof spirit,* 1 *pint. Macerate the colchicum for forty-eight hours, in* 15 *ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining* 5 *ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make* 1 *pint.*

VINUM COLCHICI—Wine of Colchicum.—*Take of colchicum corm, sliced, dried, and reduced to No.* 20 *powder,* 4 *ounces; sherry,* 1 *pint. Macerate the colchicum in the wine for seven days in a closed vessel, with occasional agitation, press and strain through calico; then add sufficient sherry to make* 1 *pint.*

Therapeutics.—Colchicum acts in over-doses as a powerful narcotic-acrid poison, causing severe vomiting and purging, burning pain in the throat, severe colicky pains in the bowels, tenesmus, great debility, a small weak frequent or fluttering pulse, cold extremities, suppression of urine, &c. Sometimes the nervous system is more affected, and there occur headache, delirium, and insensibility. It is necessary to administer the preparations of colchicum with great caution, beginning with small doses, and gradually increasing them according to circumstances, not only because different samples of the drug vary in activity, but also because some persons are violently affected by comparatively small quantities. A dose of 2½ drachms of the tincture has proved fatal. In poisoning by colchicum, the indications are to give diluents to facilitate the removal of the poison by the vomiting and purging which it causes, and to allay irritation by opiates internally and counter-irritants externally. In medicinal doses, colchicum may produce nauseant, depressant, diaphoretic, diuretic, cathartic, sedative, or anodyne effects. In small doses frequently repeated it stimulates the secreting organs; the mucous membrane of the intestines, the liver, the kidneys, and the skin being more or less affected by it. In full doses it causes nausea, vomiting, and purging, and acts as an arterial sedative; hypercatharsis, severe bilious vomiting, and salivation have followed such doses. By some, colchicum is believed to increase the quantity of uric acid in the urine, by others to diminish it. Colchicum is chiefly employed in the treatment of gout, for which it is generally regarded as a specific. It is given during an attack and in the intervals, frequently allaying the pain and shortening the seizure, but it is not infallible, and in many cases fails to afford any great measure of relief; at best, it is only a palliative, not a curative remedy. It has been said also that its use tends to encourage the frequency of the seizures, whilst its influence over them is gradually diminished. The manifestation of its physiological action is probably not essential to its therapeutical effects. In rheumatism, colchicum is much less efficacious than in gout, and is only given now in chronic cases. In both it should be given in doses just short of producing diarrhœa. The reason for its beneficial effects has never been explained satisfactorily.

Veratrum viride—American White Hellebore.—Indian Poke.

VERATRI VIRIDIS RHIZOMA — *Green Hellebore Rhizome* — *Syn.* Veratri Viridis Radix.—The dried rhizome and rootlets of *Veratrum viride*, Solander (*V. album*, *var.* Regel and others, &c.).

Characters.—Entire, or sliced or divided, and either with or without attached rootlets. When entire from 1 inch or more in length, and ¾ inch or more in diameter, erect, obconical, obtuse, or truncated at the apex, dark-brown externally, whitish within. Frequently bearing at its upper end the concentrically arranged remains of leaves, and giving off on all sides numerous much-shrivelled yellowish-white rootlets several inches long; or the latter are detached and mixed with it, in which case the rhizome is marked with scars. Inodorous, but causing sneezing when powdered, taste bitterish and very acrid.

Dose.—1 to 2 grains.

Active Principles.—It contains a number of alkaloids, *Jervine*, $C_{26}H_{37}NO_3$, crystalline, coloured yellow and green by sulphuric acid; not sternutatory; *Pseudojervine*, $C_{29}H_{43}NO_7$, closely resembling it; *Veratroidine*, non-crystalline and sternutatory; *Rubijervine*, $C_{26}H_{43}NO_3$; *Cevadine; Veratrine*, and probably others. The total amount is not large. *Resin*, *starch*, &c.

Official Preparation.

Tinctura, . 1 in 5. *Dose*, 5 to 20 minims.

TINCTURA VERATRI VIRIDIS—Tincture of Green Hellebore.—*Take of green hellebore root, in coarse powder*, 4 *ounces; rectified spirit*, 1 *pint. Made by maceration and percolation.*

Therapeutics.—The therapeutic value of this drug has undoubtedly been much overrated. It requires very great care in its administration to prevent the serious depression and distressing nausea resulting from its use being carried to a dangerous degree. It acts as a sedative and antiphlogistic, but it is very questionable whether the sedative effect induced by it on the circulation is not too dearly bought by the nausea and disagreeable results which it produces. In America it is used to lessen cardiac excitement in hypertrophy and in Bright's disease, and in the early stages of acute pneumonia and other inflammations, to calm the circulation.

Schœnocaulon officinale—Sabadilla—Cevadilla.

Sabadilla—*Cevadilla.*—The dried ripe seeds of *Schœnocaulon officinale*, A. Gray (*Asagræa officinalis*, Lindl.). The seeds are sometimes imported in, or mixed with, their pericarps, but these should be rejected before the seeds are used.

Characters.—About ¼ inch or less long, narrow, fusiform or somewhat scimitar-shaped, prolonged above into a membranous wing, somewhat compressed, shining, wrinkled, blackish-brown. Taste, bitter, acrid; inodorous, but when powdered producing violent sneezing. The fruit consists of three light-brown papyraceous follicles, about ½ inch long, and each containing from one to three seeds.

Active Principles.—Cevadilla contains a number of alkaloids, *Veratrine*, $C_{37}H_{53}NO_{11}$, amorphous, decomposing into veratric acid and verine; *Cevadine*, $C_{32}H_{49}NO_9$, is crystalline and decomposes into cevadic acid and cevine; *Cevadilline*, $C_{34}H_{53}NO_8$. *Cevadic* and *Veratric Acids*, *fat*, &c., are also present.

VERATRINA—Veratrine—*Syn.* Veratria.—An alkaloid or mixture of alkaloids obtained from Cevadilla; not quite pure.

PREPARATION.—*Take of cevadilla*, 2 *pounds; distilled water, rectified spirit, solution of ammonia, hydrochloric acid, of each a sufficiency; purified animal charcoal*, 60 *grains. Macerate the cevadilla with half its weight of boiling distilled water in a covered vessel for twenty-four hours. Remove the cevadilla, squeeze it, and dry thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel, or by winnowing it gently on a table with a sheet of paper.*[1] *Grind the seeds in a coffee-mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be coloured.*[2] *Concentrate the spirituous solution by distillation, so long as no deposit forms, and pour the residue, while hot, into twelve times its volume of cold distilled water.*[3] *Filter through calico, and wash the residue on the filter with distilled water till the fluid ceases to precipitate with ammonia.*[4] *To the united filtered liquids add the ammonia in slight excess,*[5] *let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with distilled water till the fluid passes colourless. Diffuse the moist precipitate through* 12 *fluid ounces of distilled water, and add gradually, with diligent stirring, sufficient hydrochloric acid to make the fluid feebly but persistently acid. Then add the animal charcoal,*[6] *digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add ammonia in slight excess,*[5] *and when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water till the washings cease to be affected by nitrate of silver acidulated with nitric acid. Lastly, dry the precipitate first by imbibition with filtering paper, and then by the application of a gentle heat.*

Characters.—Pale-grey, amorphous, without smell, but even in the most minute quantity powerfully irritating the nostrils; strongly and persistently bitter, and highly acrid; insoluble in water, soluble in spirit and ether, and in diluted acids, leaving traces of an insoluble brown resinoid matter. It dissolves in nitric acid, yielding a yellow solution, and in sulphuric acid, forming a deep red solution which exhibits a green fluorescence by reflected light. Warmed with hydrochloric acid, it dissolves with production of blood-red colour. Heated with access of air, it melts into a yellow liquid, and burns away, leaving no residue. An active poison.

Dose.—$\frac{1}{32}$ to $\frac{1}{12}$ grain.

[1] This is simply a preliminary procedure to separate the seeds from the fruit. [2] The spirit removes the alkaloids, resin, and colouring matter. [3] The resin is precipitated. [4] Showing that all the alkaloid has been washed through the filter. [5] Precipitates the alkaloids. [6] To remove the colouring matter.

Official Preparation.

Unguentum, . . . 1 in 62 about.

UNGUENTUM VERATRINÆ—Ointment of Veratrine.—*Take of veratrine, 7 grains; hard paraffin, ¼ ounce; soft paraffin, ¾ ounce; olive oil, 1 fluid drachm. Rub the veratrine and the oil together; melt the hard and soft paraffins, and when in cooling they begin to thicken, mix the whole thoroughly in a mortar till cold.*

Therapeutics.—Cevadilla and the alkaloid veratrine act in overdoses as powerful poisons, producing severe pain, vomiting, purging, collapse, depression of the circulation, and tremors. There is no official preparation of cevadilla for internal use, and it is rarely given; but it has been recommended as an anthelmintic in tape worm and ascarides. Veratrine is very rarely given internally, although it has been recommended as a substitute for colchicum in gout and rheumatism, also for the relief of certain painful neuralgic affections, and as an antiphlogistic in inflammatory diseases. When applied to the nostril, even in very minute quantity, it acts powerfully as a sternutatory and errhine. Externally it acts at first as a slight local irritant, but finally as an anodyne by paralysing the terminations of sensory nerves. It has been recommended in rheumatism, in neuralgia, &c.

Veratrine has a curious effect on muscle, the contraction of which is greatly prolonged under its influence. The treatment of poisoning is to evacuate the stomach, and give alcoholic and other stimulants freely.

Veratrum album—White Hellebore—(*not official*).—It is a large perennial herb, growing in mountainous regions in Europe. The rhizome closely resembles that of American hellebore. The constituents are *Jervine, Pseudojervine, Rubijervine, Veratrine,* &c.

Its action is similar to that of cevadilla, and it is only used externally.

Nat. Ord. **PALMÆ**—The Palm Order.—Arborescent plants, chiefly tropical, but extending to a limited extent into temperate climates. Palms furnish many useful products, such as starch, sugar, oil, wax, edible fruits, &c. None of them are official.

Areca Catechu—The Betel-Nut Palm—the Areca-Nut Palm—(*not official*).—It is cultivated for the sake of its seeds in India, China, the Malayan Archipelago, &c. The fruit is about 2 inches long, and contains a single seed, which is the Areca or Betel Nut. The latter is about the size of a nutmeg, of a rusty colour externally, and marked with a hilum and a network of veins. They are hard and difficult to break, internally somewhat marbled. No marked odour, taste slightly astringent.

The *active principles* are several alkaloids—*Arecoline*, $C_8H_{13}NO_2$, an oily body yielding crystalline salts ; *Arecaine*, $C_7H_{11}NO_2$, in crystals, non-poisonous. *Fat* (14 per cent.), *resin*, *red colouring matter*, *tannin* (about 15 per cent.), *gum*, &c.

Dose.—60 to 240 grains.

Therapeutics.—It is used as an astringent in diarrhœa, as a tooth-powder, and as an anthelmintic in tapeworm and round worm to a very limited extent. Its chief use is as a stimulant narcotic, for which purpose it is very universally employed in the East as a masticatory, under the name of *Betel*, and is chewed along with unslaked lime and the leaves of the betel pepper (*Chavica Betle*). The nut is either softened in water or is taken when young and tender, cut into small pieces, and rolled up with lime in a leaf of the betel pepper. The lime serves to more thoroughly extract the alkaloids, while the pepper leaf imparts pungency. It colours the saliva red.

Calamus Draco.—Rotang Jernang (Malay) is one of the Rotang or Rattan Palms, having long flexible stems, which cling to the branches of other trees by the spines on the leaf stalk. *Habitat*—Borneo, Sumatra, &c. It yields Dragon's Blood—*Sanguis Draconis*, *Resina Draconis*—a spontaneous resinous exudation from the fruit while ripening (*not official*). It is friable, and is separated by shaking or beating the fruits in a sack ; may be then softened by gentle heat, moulded into sticks or balls, and wrapped in a piece of palm leaf. Inferior qualities are got by heating the fruit, or boiling it in water.

It is found in tear-like grains, in globular pieces about 1½ inch in diameter, in cylindrical sticks about a foot long and ½ inch thick, or in irregular cakes. Externally brown-red, internally bright red, brittle; inodorous unless heated, when it gives off an aroma resembling benzoin, soluble in alcohol, chloroform, benzol, and alkalis.

It contains a *red resin*, *waxy matter*, *benzoic acid*, sometimes *cinnamic acid*, and is used to make plasters, tooth-powders, and varnishes.

Adulterations, &c.—It is often adulterated with insoluble matters. A fine colour is the criterion of quality. Other inferior kinds of dragon's blood are also imported.

Metroxylon Sagu—Sago Palm.

It is a tree 40 or 50 feet high, growing in Java, Borneo, and adjacent islands. It and several other species yield sago (*not official*). The medullary matter of the stem is reduced to a coarse powder, and the starch washed out of it, and then granulated. One tree will yield 600 lbs.

It is a pure form of starch, bland, non-irritating, and easily digested.

SUB-CLASS III.—GLUMIFERÆ.

Nat. Ord. **GRAMINEÆ**—The Grass Order.—Herbaceous plants, forming herbage in temperate climates, and sometimes becoming arborescent in tropical countries. The order furnishes most important food substances both for man and animals.

Official Plants.

Name.	Part Used.	Habitat.
TRITICUM SATIVUM.	The ground grain (wheat); Bread; Starch.	Temperate climates.
ZEA MAYS.	Starch.	Warmer climates.
ORYZA SATIVA.	"	India.
HORDEUM DISTICHON.	Grain.	Widely cultivated.

Triticum sativum.—Wheat.

FARINA TRITICI—*Wheaten Flour.*—The grain of *Triticum sativum*, Linn. (*T. æstivum*, Linn.; *T. vulgare*, Vill., &c.), ground and sifted.

Botany.—*Culms*, simple, glaucous, jointed. *Spike*, four-cornered, imbricated. *Spikelets*, generally four-flowered; flowers, distichous. *Glumes*, two, opposite, equal, ribbed. *Grain*, free, convex externally, marked with a deep furrow internally. *Habitat,* Tartary; widely cultivated.

Finely-ground wheat has an average percentage composition somewhat as follows:—*Nitrogenous Substances* (gluten chiefly), 9; *Fat,* a little over 1; *Carbohydrates* (chiefly starch, also sugar and gum), 74; *Cellulose,* 0·3 to 0·8; *Ash,* 0·5 to 0·8; and *Water,* 14. When coarsely ground, or in grain, it contains proportionately more *albumin* and *cellulose,* and less *starch.*

Used in making *Cataplasma Fermenti.*

Mica Panis—*Crumb of Bread.*—The soft part of bread made with wheaten flour.

Used in making *Cataplasma Carbonis.* When washed to get rid of the salts and reduced to a fine dry powder it is sometimes employed as an excipient for pills.

Amylum—*Starch,* $C_6H_{10}O_5$.—The starch procured from the grains of common wheat, *Triticum sativum,* Lam.; maize, *Zea mays,* Linn.; rice, *Oryza sativa,* Linn.

Characters and Tests.—In fine powder or in irregular, angular, or columnar masses, which are readily reduced to powder; white, inodorous. When lightly rubbed in a mortar with a little cold distilled water, the mixture is neutral[1] in reaction, and the filtered liquid does not become blue on addition of a solution of iodine.[2] Mixed with boiling water and cooled, it gives a deep blue colour with iodine.[2] Under the microscope, these varieties of starch present the following characters:—1. Wheat starch: A mixture of large and small granules, which are lenticular in form, and marked with faint concentric striæ surrounding a nearly central hilum. 2. Maize starch: Granules more uniform in size, frequently polygonal, somewhat smaller than the large granules of wheat starch, and having a very distinct hilum, but without evident concentric striæ. 3. Rice starch: Granules extremely minute, nearly uniform in size, polygonal, hilum small, and without striæ.

[1] Starch is generally alkaline, however. [2] Cold water does not rupture the envelope of the granules (unless violently rubbed in a mortar), and hence no starch escapes; when boiling water is used, the envelope is ruptured and the contents pass into the water. Iodine gives a blue precipitate if much starch be present—iodide of starch—and if collected and dried, it forms a fine deep-blue powder.

Glucose, Dextrose or *Starch Sugar* is made by boiling starch for some time with dilute sulphuric acid, when it is gradually converted into grape sugar. It is in yellowish or whitish masses, without smell, sweet, soluble in water. Commercial liquid grape sugar (generally called glucose) contains a large amount of dextrin.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Glycerinum.	Starch.	1 in 10 by weight.	...
Mucilago.	,,	1 in 36 about.	...

Contained also in *Pulvis Tragacanthæ Compositus* (1 in 6).

GLYCERINUM AMYLI—GLYCERINE OF STARCH.—*Take of starch*, 1 *ounce; glycerine*, 5 *fluid ounces; distilled water*, 3 *fluid ounces. Stir them together in a porcelain dish and apply heat, stirring constantly until the starch particles are completely broken, and a translucent jelly is formed.*

Contained in *Suppositoria Acidi Carbolici cum Sapone,—Acidi Tannici cum Sapone,* and—*Morphinæ cum Sapone.*

On keeping for a week or two, this preparation loses its plasticity and becomes curdy. If reheated and stirred, it resumes its former consistency.

MUCILAGO AMYLI—MUCILAGE OF STARCH.—*Take of starch*, 120 *grains; distilled water*, 10 *fluid ounces. Triturate the starch with the water, gradually added, then boil for a few minutes, stirring constantly.*

Contained in *Enema Aloes,—Magnesii Sulphatis,—Opii,—Terebinthinæ.*

Therapeutics.—Medicinally, flour is sometimes employed for dusting over excoriated, burned, and inflamed surfaces; and bread is used in the preparation of poultices. Starch is very extensively employed as a dusting powder in inflamed and irritable conditions of the skin, in slight burns, and for cosmetic purposes; the mucilage of starch is employed as a demulcent, as a vehicle for enemata, as an antidote in poisoning by iodine; it enters into all the official enemata, except that of asafœtida. The glycerine is also a good application in roughness of the skin of the hands, and chaps. Wheat and starch are chiefly of importance as articles of diet.

Zea Mays—Maize—Indian Corn.—The grain is largely used as an article of diet; the starch is official in the B.P.

Oryza sativa—Rice.—Rice is chiefly important dietetically; the starch is official in the B.P.

Hordeum distichon—Barley—Bere.

HORDEUM DECORTICATUM—*Pearl Barley.*—The dried seed of *Hordeum distichon*, Linn. (*H. vulgare*, Linn.), divested of its integuments. From plants cultivated in Britain.

Characters.—White, rounded, retaining a trace of the longitudinal furrow. Taste and odour farinaceous, like cereals generally.

The husk is removed from barley by passing it through a mill of peculiar construction. When the husk merely is removed, it is known as Scotch, hulled, or pot-barley ; but when the seeds are entirely deprived of their integuments, and are furthermore rounded and polished, it is termed pearl-barley. Barley consists of starch, gluten, sugar, gum, &c.

Official Preparation.

Decoctum, . 1 in 10. *Dose*, ad. lib.

DECOCTUM HORDEI—DECOCTION OF BARLEY.—*Take of pearl barley*, 2 *ounces; distilled water*, $1\frac{1}{2}$ *pint. Wash the barley in cold water, and reject the washings; boil the washed barley with the distilled water for twenty minutes in a covered vessel, and strain. Product about* 1 *pint.*

Therapeutics.—Decoction of barley is used as a demulcent drink in febrile and inflammatory diseases, and as a vehicle for other medicine. It is most frequently employed in inflammatory affections of the respiratory and urinary organs. Raisins, sugar-candy, liquorice-root, and slices of lemon, are sometimes added.

Avena sativa—Oats—(*not official*).—Oatmeal contains about 14 per cent. *Nitrogenous Substances* (gluten largely), 5 of *Fat*, 65 of *Carbohydrates* (chiefly starch), 2 or 3 of *Cellulose*, and about 10 of *Water*.

The meal is sometimes used for poultices ; while gruel and demulcent drinks are also made from it. As an article of diet it tends to obviate constipation, but many people are unable to take it habitually owing to its irritating effects on the gastro-intestinal canal. Like the other cereals, its use is chiefly dietetic, not medicinal.

Agropyron repens (*Trititcum repens*)—Couch Grass—Quitch Grass—Dog's Grass—(*not official*).—*Habitat*, growing in waste places in all temperate climates.

The rhizome is long, stiff, pale-yellow, occasionally branching, and marked by nodes which bear branching roots, the remains of sheathing rudimentary leaves. For use it is freed from the rootlets, cut into short lengths (about $\frac{1}{4}$ inch), and dried. It is, therefore, in little hollow, shiny, straw-like pieces, without odour, but with a sweetish taste. It contains a good deal of a peculiar *gum* (*Triticin*) and several sugars. A decoction has been given in vesical catarrh and cystitis. The dose of the rhizome is 60 to 240 grains.

Saccharum officinarum—Sugar-Cane—(*not official*).[1]

SACCHARUM PURIFICATUM—*Refined Sugar—Saccharose—Sucrose*, $C_{12}H_{22}O_{11}$.

Characters and Tests.—Conical loaves, known in commerce as lump sugar. Readily and completely soluble in water, forming a clear bright syrup, which yields no red or yellowish precipitate, or scarcely a trace, on heating it to near the boiling-point of water for a short time with a little solution of sulphate of copper and excess of solution of potash.[2]

[1] The source of sugar is not mentioned in the B.P. It is chiefly obtained from sugar-cane and beetroot. [2] Showing absence of glucose. Syrup under the influence of ferments is apt to undergo change into grape-sugar.

Sugar is not hygroscopic, has no smell, and fuses at 320° F. (160° C.); it is soluble in half its weight of cold water, the solution being dextrogyre; soluble 1 in 100 rectified spirit, sparingly in strong alcohol, insoluble in ether. When heated to about 190° C. it blackens, and *Caramel* or *Burnt Sugar* is obtained; this has a pleasant sharp flavour, bitter taste, and peculiar smell, and does not ferment. *Barley Sugar* is cane-sugar melted and cooled; it is non-crystalline and transparent.

Sugar is contained in *Confectio Rosæ Caninæ,—Rosæ Gallicæ,—Sennæ; Extractum Sarsæ Liquidum; Ferri Carbonas Saccharata; Liquor Calcis Saccharatus; Magnesii Sulphas Effervescens; Mistura Ferri Composita,—Guaiaci,—Spiritus Vini Gallici; Pilula Ferri,—Ferri Iodidi; Pulvis Amygdalæ Compositus,—Cretæ Aromaticus,—Glycyrrhizæ Compositus,—Tragacanthæ Compositus; Sodii Citro-tartras Effervescens, Sodii Phosphas Effervescens, Sodii Sulphas Effervescens,* and all the *Lozenges* and *Syrups*.

Official Preparation.

SYRUPUS—SYRUP.—*Take of refined sugar,* 5 *pounds; distilled water,* 2 *pints. Dissolve the sugar in the water with the aid of heat; and add, after cooling, as much water as may be necessary to make the whole weigh* 7½ *pounds. Specific gravity,* 1·330.

Syrup is contained in *Confectio Opii,—Scammonii; Mistura Cretæ,—Creasoti,—Olei Ricini; Pilula Cambogiæ Composita; Syrupus Aurantii,—Chloral,—Zingiberis; Tinctura Chloroformi et Morphinæ.*

THERIACA—*Treacle.*—The uncrystallised residue of the refining of sugar. *Synonym:* Sacchari Faex.

Characters.—A thick, golden or brown, fermentable syrup, very sweet; not crystallising by rest or evaporation. Specific gravity about 1·40. Nearly free from empyreumatic odour or flavour.

Treacle is contained in *Pilula Aloes et Myrrhæ,—Asafœtidæ Composita,—Conii Composita,—Ipecacuanhæ cum Scilla,—Rhei Composita,—Scillæ Composita; Tinctura Chloroformi et Morphinæ.*

Composition.—It contains cane-sugar, mixed with flavouring and colouring matter. The sugar never crystallises out.

Therapeutics.—Sugar is used in medicine as a flavouring adjunct to other remedies, and is itself both nutrient and demulcent. It is also employed as a demulcent in irritant and corrosive poisoning. It is employed in pharmacy for a variety of purposes, such as to impart cohesiveness, to give consistence, to suspend insoluble substances, to preserve certain articles from chemical changes, &c. It enters into syrups, confections, lozenges, powders, pills, mixtures, &c. Treacle is slightly laxative in large quantity.

B. *Cryptogameæ, Acotyledoneæ, or Flowerless Plants.*

CLASS III.—ACOTYLEDONES OR ACRO-THALLOGENÆ

Sub-Class I.—Acrogenæ.

FILICES—The Fern Order.—The plants possess anthelmintic demulcent, astringent, and other properties.

Official Plant.

Name.	Part Used.	Habitat.
Aspidium Filix-mas.	Rhizome.	Indigenous.

Aspidium Filix-mas—Male Fern.

Botany.—Herbaceous plant. *Rhizome*, perennial, subterraneous, thick, tufted, scaly, with descending roots and ascending leaves or fronds. *Fronds*, three or four feet high, bipinnate, rising in a circle from the tufted rhizome; pinnules, oblong, obtuse, serrated. *Habitat*, indigenous, but very widely distributed over the globe.

Filix Mas—*Male Fern.*—The rhizome with the persistent bases of the petioles of *Aspidium Filix-mas*, Swartz (*Polypodium Filix-mas*, Linn., &c.). Collected late in the autumn,[1] divested of its scales, roots, and all dead portions, and carefully dried with a gentle heat. Should not be used if more than a year old.[2]

Characters.—From 3 to 6 or more inches in length, and the rhizome itself from $\frac{3}{4}$ to 1 inch diameter, but being entirely covered by the hard, persistent, curved, angular dark-brown bases of the petioles, is apparently 2 or more inches; brown externally, yellowish-white or brownish internally.[3] Odour feeble, but disagreeable; taste sweetish, and astringent at first; but subsequently bitter and nauseous.

Dose.—30 to 120 grains.

[1] It is then most active, although some authors regard it as being so in spring. [2] It loses its activity in a short time (see Chemistry below). [3] When fresh it is greenish internally; the older it is the yellower it becomes.

Chemistry.—The active principle is *Filicic Acid*, $C_{35}H_{42}O_{13}$, soluble in fixed and volatile oils, less so in ether and alcohol, insoluble in water. Its anhydride *Filicin*, $C_{35}H_{40}O_{12}$, forms in the dried root and in preparations which have been kept a long time, and as it is inactive, old preparations are not reliable. There is also about 6 per cent. of a *fixed oil*, some *volatile oil*, *filicitannic acid*, *resins*, *chlorophyll*, and *salts*.

Official Preparation.

Extractum Liquidum, 10 in 1. *Dose*, 15 to 30 minims.

EXTRACTUM FILICIS LIQUIDUM — LIQUID EXTRACT OF MALE FERN.—*Take of male fern, in coarse powder,* 2 *pounds; ether,* 4 *pints, or a sufficiency. Pack the male fern closely in a percolator, and pass the ether slowly through it until it passes colourless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract.*

Therapeutics.—Male fern is employed as an anthelmintic, and, when good preparations are employed, is perhaps the most successful remedy in the treatment of tape-worm. It usually acts promptly, and without causing any uneasiness, but occasionally it gives rise to nausea and griping pains. It is also used to expel anchylostoma duodenale. It varies a good deal in its activity according to age. In addition to the colicky pains which it sometimes causes, a portion may be absorbed, and give rise to some degree of mental confusion, giddiness, and tremors. It should be given in capsule or in emulsion.

Substitution. — The rhizomes of *Aspidium rigidum*, Swartz, are longer and thinner, and have the stipes loosely imbricate; *A. athamanticum*, Kunze (S. Africa), has thicker and firmer rhizomes, and are brownish internally; *A. montanum*, and others. On transverse section, the leaf bases of Filix-mas show eight vascular bundles, the others have other numbers, and this can easily be detected by a lens.

Nat. Ord. **LYCOPODIACEÆ.**

Lycopodium clavatum—Clubmoss—(*not official*).—*Habitat*, universally in temperate and colder regions.

LYCOPODIUM—*Lycopodium.*—The sporules of *Lycopodium clavatum*, and other species (*not official*). It is collected in July and August by cutting off the tops, and shaking out the spores from the sporangia.

Characters, &c.—A fine pale-yellowish powder, inodorous, tasteless, not wetted by water, very inflammable. Under the microscope the granules are seen to be tetrahedral, reticulated, and with short projections. They contain nearly 50 per cent. *fixed oil*, *sugar*, and *methylamine* in small amount. It is used as a dusting powder, and for preventing pills adhering to each other.

Adulterations. — *Pine pollen*, detected by microscope; *flour* and *starch*, by iodine; *turmeric*, red-brown with alkalies. *Talc*, *chalk*, and other inorganic bodies, increase the amount of ash, which should not be over 4 or 5 per cent.

SUB-CLASS II.—THALLOGENÆ.

Nat. Ord. **LICHENES** — The Lichen Order. — Cellular plants growing on stones on the surface of the earth, or on trees, widely distributed. They possess mucilaginous, nutrient, bitter, astringent, and other properties.

Official Plants.

Name.	Part Used.	Habitat.
CETRARIA ISLANDICA.	Whole plant.	Indigenous.
ROCCELLA TINCTORIA, and other species.	Colouring matter.	Widely distributed.

Cetraria islandica—Iceland Moss—Iceland Lichen.

Botany. — *Thallus*, erect, 2 to 4 inches high, foliaceous, dry, leathery, tufted, and irregularly divided; divisions channelled, lobed, fringed. *Apothecia*, or fructifications, brown, shield-like, or flat, with elevated border. *Habitat*, mountains of the Old and New World.

CETRARIA — *Iceland Moss* — *Iceland Lichen.* — The dried lichen, *Cetraria islandica*, Ach. (*Lichen islandicus*, Linn.).

Characters.—Foliaceous, much branched in an irregular dichotomous manner into fringed, obtuse, or truncate flattened lobes; crisp, smooth, and usually brownish or greyish-white above, whitish beneath, and marked irregularly with small white depressed spots. Almost odourless when dry, but when moistened with water, having a feeble seaweed-like odour; taste mucilaginous, and slightly bitter. A strong decoction gelatinises on cooling.

Constituents. — It contains a peculiar starchy matter, *Lichenin*, $C_{12}H_{20}O_{10}$ (about 70 per cent.), brownish, gelatinous, and insipid; it swells up in cold water, and dissolves in boiling; gelatinises on cooling. During prolonged boiling dextrin and glucose form, which do not jelly so readily. *Cetrarin* (*cetraric acid*), $C_{18}H_{46}O_8$, crystalline, insoluble in cold, soluble slightly in hot water, confers on it the bitter taste. *Sugar, cellulose* (about 16 per cent.), *oxalic* and *fumaric acids*, and *salts* are also present.

Official Preparation.

Decoctum, . . 1 in 20. *Dose*, 1 to 4 fluid ounces.

DECOCTUM CETRARIÆ — DECOCTION OF ICELAND MOSS.— *Take of Iceland moss*, 1 *ounce; distilled water*, 1 *pint. Wash the moss in cold water to remove impurities; boil it with the distilled water for ten minutes in a covered vessel, and strain with gentle pressure while hot. Then pour distilled water over the contents of the strainer until the strained product measures a pint.*

Therapeutics.—Iceland moss is demulcent and bitter. When deprived of its bitterness, either by macerating in hot water, or in a very weak alkaline solution, it may be used as an article of diet in the form of jelly, made with water or milk, and variously flavoured. It is comparatively little used. Cetrarin has been employed to a small extent as a bitter.

Roccella tinctoria, and other species—Litmus—Orchella Weed—Dyers' Weed—Rock Moss.

It grows on sea-shore rocks, and is found on the shores of the Mediterranean, Atlantic, Pacific, and other oceans.

LITMUS.—A blue pigment, prepared from various species of *Roccella*, D.C.

The best is made in Holland from *R. tinctoria*, the ground lichens being macerated for several weeks in an alkaline solution, which removes the colouring material. Some calcareous or siliceous matter is generally mixed with it to give it consistence. It occurs in small pieces, friable, granular, and of a deep blue or violet colour. Taste saline and pungent. Soluble in water and partially in alcohol. The colouring matter is gradually formed by the action of oxygen on a colourless body present.

SOLUTION OF LITMUS. — *Take of litmus, in powder,* 1 *ounce; rectified spirit,* 10 *fluid ounces; distilled water,* 10 *fluid ounces. Boil the litmus with* 4 *ounces of the spirit for one hour and pour away the clear fluid; repeat this operation with* 3 *ounces of the spirit; and a third time with the remainder of the spirit. Digest the residual litmus in distilled water, and filter.*

LITMUS PAPER BLUE.—*Unsized white paper steeped in solution of litmus, and dried by exposure to the air.*

LITMUS PAPER RED.—*Unsized paper steeped in solution of litmus, which has been previously reddened by the addition of a very minute quality of sulphuric acid, and dried by exposure to the air.*

LITMUS TINCTURE.—*Take of litmus, in powder,* 1 *ounce; proof spirit,* 10 *fluid ounces. Macerate for two days in a closed vessel, and filter.* (Not in B.P.)

Litmus, which, with its preparations, is placed in the Appendix, B.P., is used only as a test for acids and alkalies, the acids giving a red colour with blue litmus; the alkalies restoring the blue colour of reddened litmus.

Nat. Ord. **FUNGI.**

Official Plants.

CLAVICEPS PURPUREA, .	Ergot of Rye.
SACCHAROMYCES CEREVISIÆ,	Yeast.

Claviceps purpurea.

ERGOTA—*Ergot.*—The sclerotium of *Claviceps purpurea,* Tulasne, produced between the pales, and replacing the grain of *Secale cereale,* Linn., the common rye.[1]

Characters.—Subcylindrical or obscurely triangular, tapering towards the ends, generally arched or curved; from $\frac{1}{3}$ to $1\frac{1}{2}$ inch long; furrowed longitudinally on each side, but especially on the concave one, and often irregularly cracked; violet-purple externally, whitish or pinkish-white within; fracture short. Odour, peculiar and disagreeable,[2] more especially if the powder be triturated with solution of potash. Taste, mawkish and rancid.

Dose, 20 to 30 grains.

[1] Rye affected by the fungus is sometimes called *Secale cornutum*, horned rye, or sometimes spurred rye, the affected grains standing out from the rest of the head like a horn or cockspur (old French, *Ergot*, a cockspur). Ergot is a stage in the life-history of the fungus, which is a biennial organism. It commences as a sticky substance, the *mycelium*, between the pales at the base of the ovary. This is filamentous in structure, penetrates the substance of the grain, and gradually destroys it.

The filaments increase in quantity and density, and ultimately form what is called the *sclerotium*, or Ergot. This is a quiescent condition, but if ergot be placed in favourable circumstances, groups of little mushroom-shaped *thalli* spring up through the surface, and these produce *spores*. The spores in turn, finding a nidus in the head of rye, produce the mycelium again.

One or several grains on a head may be ergotised, those not attacked remaining in the normal healthy condition, and the general nutrition of the plant being unaffected. The same fungus grows on many grasses.

Ergot keeps badly, owing to the attacks of a mite, and to chemical changes occurring in it. It is obtained chiefly in Spain and Russia.

[2] Due to trimethylamine, a volatile body.

Chemistry.—The composition is very complex, and few of the active constituents have been obtained in a state of chemical purity. There is nearly 35 per cent. of an inert *fixed oil*; *Trimethylamine*; *Sphacelinic Acid* (the constituent which contracts the vessels and causes gangrene); *Cornutine*, an alkaloid (the principle which causes the convulsions); *Ergotinic Acid*; *Ergotin* (Wenzell); *Ecbolin* (Wenzell), seems to be impure cornutine; *Ergotinin* (Tanret); an unnamed alkaloid without physiological action, and a volatile alkaloid, like conine, also unnamed, have all been described, along with several other substances. The body having the peculiar specific action on the uterus has not been satisfactorily determined, and investigators are greatly at variance regarding several of the above substances. Possibly ergot may vary in composition.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Ergotinum.	Liquid extract.	...	2 to 5 grains.
Extractum liquidum.	Ergot crushed.	1 in 1.	10 to 30 minims.
Infusum.	" "	1 in 40.	1 to 2 fluid ounces.
Injectio hypodermica.	Ergotin.	1 in 2.	3 to 10 minims.
Tinctura.	Ergot finely comminuted.	1 in 4.	5 to 30 minims.

ERGOTINUM—Ergotin.—Purified Extract of Ergot, commonly called Ergotin, Ergotine, or Bonjean's Ergotine.

Take of liquid extract of ergot, rectified spirit, of each 4 *fluid ounces. Evaporate the fluid extract by a water-bath to a syrupy consistence, and, when cold, mix with the spirit. Let it stand for* ½ *hour, then filter, and evaporate the filtered liquid to the consistence of a soft extract.*

EXTRACTUM ERGOTÆ LIQUIDUM — Liquid Extract of Ergot.—*Take of ergot, crushed,* 1 *pound; distilled water,* 6 *pints; rectified spirit,* 6 *fluid ounces. Digest the ergot in* 4 *pints of the water for* 12 *hours. Draw off the infusion, and repeat the digestion with the remainder of the water. Press out, strain, and evaporate the liquor by the heat of a water-bath to* 11 *fluid ounces; when cold, add the spirit. Allow it to stand for an hour to coagulate, then filter. The product should measure* 16 *fluid ounces.*

INFUSUM ERGOTÆ—Infusion of Ergot.—*Take of ergot, in coarse powder,* ¼ *ounce; boiling distilled water,* 10 *fluid ounces. Infuse in a covered vessel for half an hour, and strain.*

INJECTIO ERGOTINI HYPODERMICA—Hypodermic Injection of Ergotin.—*Take of ergotin,* 100 *grains; camphor water,* 200 *fluid grains. Dissolve by stirring them together. The solution should be made as required for use.*

TINCTURA ERGOTÆ—Tincture of Ergot.—*Take of ergot, finely comminuted,* 5 *ounces; proof spirit,* 1 *pint; made by maceration and percolation.*

TINCTURA ERGOTÆ AMMONIATA — Ammoniated Tincture of Ergot, B.P.C.—(*not official*).—*Take of ergot, in No.* 20 *powder,* 10 *ounces; aromatic spirit of ammonia, a sufficiency. Moisten the powder with a suitable quantity of the menstruum, and macerate for*

12 *hours; then pack in a percolator, and gradually pour aromatic spirit of ammonia upon it until one pint of tincture is obtained.*

Dose.—10 to 60 minims.

ACIDUM SCLEROTICUM—Sclerotic Acid—(*not official*).

Dose.—$\frac{1}{3}$ to $\frac{3}{4}$ grain hypodermically.

ERGOTININE—Ergotinine (Tanret)—(*not official*).—An alkaloid insoluble in water, soluble in alcohol.

Dose.—$\frac{1}{100}$ to $\frac{1}{50}$ grain.

Therapeutics.—Ergot of rye in over-doses occasions nausea, vomiting, colicky pains, headache, and occasionally delirium and stupor. When taken for a length of time, as in bread made with diseased rye, it produces two conditions, termed gangrenous ergotism and convulsive ergotism; in the former, dry gangrene of the ears, feet, and other distal parts is the most prominent symptom, while in the latter, tremors and local spasms predominate, but mixed cases are most common. Formerly epidemics of ergotism were not uncommon, owing to the rye being extensively diseased, but of late years such outbreaks have been few and very local. In medicinal doses it acts especially on the circulation and on the parturient uterus. In the circulation it causes arterial contraction, due to a direct action on the muscular walls of the small arteries, as well as on the vaso-motor centres. It also causes contraction of the bladder, and increased peristalsis and contraction of the uterus, probably due to its action on unstriped muscular fibre. Upon the uterus of parturient women, ergot has a very decided action, increasing the length and force of the pains, and in a sufficient dose inducing a tetanic condition of the whole organ. But it must be borne in mind that the uterine contraction caused by ergot differs from normal pains in being more continuous and not interrupted, and more liable to prove injurious to both mother and child unless it be prescribed with discretion. The danger to the mother consists in the risk of rupture of the uterus or laceration of the perinæum. This, however, is not nearly so great as the risk to the child, because the continuous uterine contractions endanger the life of the child by interfering with or arresting the circulation between the placenta and fœtus, so that the latter may die from asphyxia unless delivery occur very speedily. That the danger to the child is a real one, and not merely hypothetical, is shown by the results of the committee of the French Academy of Medicine, which investigated the subject, and adopted the conclusions of M. Depaul—viz., that except in miscarriage, in certain labours attended with hæmorrhage, and at the conclusion of natural labours, parturient women would be gainers by the complete disuse of ergot.

These considerations show that ergot should not be given during labour in inertia of the uterus if there is much resistance to the birth of the fœtus, as in primiparæ ; even in other pregnancies it should only be given when there is no obstruction to the birth of the fœtus, and at the close of parturition to obviate any tendency to post-partum hæmorrhage.

It is given in atonic conditions of the uterus, as in subinvolution after childbirth, in chronic endometritis, and in fibroid tumours. It is useful in all forms of internal hæmorrhage, especially where the part cannot be directly reached, as in hæmoptysis and menorrhagia, also in epistaxis. It is given by the mouth, unless a rapid action is desired, when subcutaneous injection is always practised. In congestion of the spinal cord and other local congestions, and in some cases of diarrhœa, it lessens the blood supply to the part. It is also used in night sweats, and to restrain the secretion of milk.

Substitutes.—Ergot of wheat is thicker and shorter, *ergot of oat* is thinner ; ergot of *Arundo Ampelodesmos* (N. Africa), known as Diss, 1 to 3 inches long, about $\frac{1}{10}$ inch broad, and arched or twisted spirally, have all been used alone, or mixed with ergot of rye.

Ustilago Maydis—Corn Smut—The Ergot of Maize—(*not official*).—In U.S.P. It is in irregular globose masses, sometimes 6 inches in diameter, consisting of a blackish gelatinous membrane, enclosing numerous brown-black globular and nodular spores. Odour and taste unpleasant. The active principles are probably much the same as those of ergot, and its uses are the same. Some authorities state that it has very little activity.

Dose.—15 to 30 grains ; of the fluid extract, 10 to 60 minims.

Saccharomyces cerevisiæ.

CEREVISIÆ FERMENTUM—*Beer Yeast.*—The ferment obtained in brewing beer, and produced by *Saccharomyces* (*Torula*, Turpin) *cerevisiæ*, Meyen.

Characters.—Viscid, semifluid, frothy, exhibiting, under the microscope, numerous isolated roundish or oval cells, or short branched filaments, composed of united cells ; odour peculiar, taste bitter.

Dose.—$\frac{1}{2}$ to 1 ounce.

It is the ferment which converts grape-sugar into alcohol, a large number of bye-products being formed at the same time. It is often pressed into moist cakes, and used in that form, but fungi are very apt to grow on it.

Official Preparation.—Cataplasma.

CATAPLASMA FERMENTI—YEAST POULTICE.—*Take of beer yeast,* 6 *fluid ounces; wheat flour,* 14 *ounces; water, heated to* 100° *F.* (37°·8 *C.*), 6 *fluid ounces. Mix the yeast with the water, and stir in the flour. Place the mass near the fire till it rises.*

Therapeutics.—Yeast has been recommended in typhus and typhoid fevers, in which it is said to relieve tympanitic distension, and to remove petechiæ and the blackness of the tongue; it has also been employed in dysentery. The poultice is used as a stimulant and antiseptic application to sloughing parts, ill-conditioned ulcers, recent bruises, &c. It destroys the offensive odour, and promotes the separation of the dead tissues. It is very little used.

Nat. Ord. **ALGÆ.**

Fucus vesiculosus—Bladder Wrack—Sea Wrack—Cut-weed—(*not official*).—It is a seaweed extremely abundant on our shores, growing everywhere on rocks, &c. The entire alga is used dried. It contains *mucilage, sugar, cellulose,* &c., and also considerable quantities of *iodides, bromides, chlorides, phosphates,* and *sulphates.* These salts form about 14 to 20 per cent. of the dried plant.

It and other seaweeds furnish kelp. The *dose* is about 120 grains, and it has been used as an alterative in scrofula and in obesity. A liquid extract (1 to 2 drachms) may be used. It forms the basis of certain preparations advertised for the cure of corpulence.

Chondrus crispus—Irish Moss—Carrageen Moss—(*not official*).—It is a seaweed, very abundant on our shores, and very variable in form, size, and colour, no two specimens being exactly alike. Chiefly collected on the coast of Ireland. It is yellowish or whitish, translucent when softened in water, very much segmented; odour slight and seaweed-like; taste mucilaginous, somewhat saline. It consists of *mucilaginous bodies* chiefly (54 per cent.), *albumins,* &c. (10 per cent.), *cellulose,* and a large amount of *salts.* It gelatinises on cooling after being boiled with about 30 parts of water.

Uses.—Same as Iceland moss.

DIVISION II.—ANIMAL KINGDOM.

Class Mammalia.

Castoreum—Castor—(*not official*).—The preputial follicles and their secretion of *Castor Fiber*, the Beaver, dried, separated from the somewhat shorter and smaller oil-sacs which are frequently attached to them; from Hudson's Bay territory.

Characters.—Follicles in pairs, about 3 inches long, fig-shaped, firm, and heavy, brown or greyish-black; containing a dry resinous reddish-brown or brown, highly odorous secretion, in great part soluble in rectified spirit and in ether.

Dose.—10 to 30 grains.

North American, Canadian, or Hudson's Bay castor, the chief variety of commerce, consists of two sacs, which are united by a ligamentous band; they are reddish-brown and wrinkled. During life, the secretion contained in the follicles is fluid, but it speedily concretes after the death of the animal. When dry, they break with a resinous fracture. The sacs are sometimes empty. Castor has a strong peculiar odour, and a bitter aromatic taste; it contains a *volatile oil*, and a peculiar white, crystalline, fatty substance, termed *Castorin*, *carbolic acid*, *salicin*, *cholesterin*, *fat*, *salts*, &c. Castor yields its active properties to alcohol and to ether, but very sparingly to water.

TINCTURA CASTOREI—Tincture of Castor—(*not official*).—*Take of castor, in coarse powder,* 1 *ounce; rectified spirit,* 1 *pint. Macerate for* 7 *days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient rectified spirit to make* 1 *pint.*

Dose.—$\frac{1}{2}$ to 2 fluid drachms.

It is stimulant, antispasmodic, and emmenagogue, but is little used in modern medicine.

Moschus—Musk.—The inspissated secretion from the preputial follicles, dried, of *Moschus moschiferus*, the musk deer, imported from China and India.

Characters and Test.—In irregular reddish-black, rather unctuous grains; having a strong, peculiar, very diffusible odour, and a bitter aromatic taste; contained in a round or slightly oval membranous sac, about 2 inches in diameter, nearly smooth on one side, covered on the outer side with stiff greyish hairs, arranged in a concentric manner around its central orifice. It should be free from earthy impurities.

Musk contains a peculiar *odorous principle* not yet isolated, *ammonia, stearin, olein, cholesterin, numerous salts,* &c. Ash about 8 per cent.

Dose.—5 to 10 grains, in pill or emulsion.

Therapeutics.—Musk acts as a stimulant and antispasmodic, but in consequence of its high price and liability to adulteration, it is not much employed. It has been given in hysteria, epilepsy, chorea, hooping-cough, spasmodic asthma, hiccup, infantile convulsions, in low typhoid diseases, pneumonia, and bronchitis.

Adulterations.—*Dried blood, resin, earthy matters,* &c., may all be mixed with it.

Lac—Milk—The Fresh Milk of the Cow, *Bos Taurus.*

Composition.—A good average milk has the following percentage composition: *water,* 86·8; *albumin,* 4; *fat,* 3·7; *carbohydrates* (lactose chiefly), 4·8; *salts,* 0·7. The albumin is not coagulated by heat, but is so by acids.

Used in making *Mistura Scammonii.*

Therapeutics.—Besides its nutritive qualities, milk acts as an emollient and demulcent, and is useful both as an antidote and as a protecting agent in corrosive and irritant poisoning. It is largely used in the treatment of different forms of dyspepsia; it is apt to curdle on the stomach, but this may be readily obviated by mixing it with lime water, soda or potash water, or fluid magnesia. Milk is also possessed of diuretic properties, and besides being nutritive, is therapeutically useful in acute and chronic albuminuria. Milk with lime water, and milk diet, are much used in diarrhœa. Externally, it is also used as a soothing application in the form of bread-and-milk poultice, and mixed with warm water, as an eye-wash.

Saccharum Lactis — Sugar of Milk ($C_{12}H_{24}O_{12}$).—Crystallised sugar, obtained from the whey of milk by evaporation.

Characters.—Usually in cylindrical masses, two inches in diameter, with a cord or stick in the axis, or in fragments of cakes; greyish-white, crystalline on the surface and in its texture, translucent, hard, scentless, faintly sweet, gritty when chewed. Soluble in about 7 parts cold, and 1 part boiling water.

Present as a diluent in *Pulvis Elaterini Compositus.*

Therapeutics.—Sugar of milk is chiefly used as a vehicle and diluent of other powders, being hard and almost tasteless. It is diuretic, and has been used as such in dropsy.

Fel Bovinum Purificatum.—The Purified Gall of the Ox, *Bos Taurus.*

PREPARATION.—*Take of fresh ox bile, 1 pint; rectified spirit, a sufficiency. Evaporate the bile to 5 fluid ounces, and mix it with ½ pint of the spirit by agitation in a bottle, and set aside for twelve hours until the sediment subsides. Decant the clear solution and filter the remainder, washing the filter and contents with a little more of the spirit. Distil off most of the spirit from the mixed liquids, and evaporate the residue in a porcelain dish by the heat of a water-bath until it acquires a suitable consistence for forming pills.*

Characters and Tests.—A yellowish-green substance, having a taste partly sweet and partly bitter, soluble in water and in spirit. A solution of 1 or 2 grains of it, in about a fluid drachm of water, when treated, first with a drop of freshly-made syrup, consisting of 1 part of sugar and 4 of water, and then with sulphuric acid, cautiously added, until the precipitate at first formed is redissolved, gradually acquires a cherry-red colour, which changes in succession to carmine, purple, and violet.[1] Its watery solution gives no precipitate on the addition of rectified spirit.[2]

Dose.—5 to 10 grains.

[1] Indicative of the presence of bile acids. [2] It therefore contains no mucus.

The gall bladder of the ox contains a greenish-brown, viscid alkaline fluid, which has an unpleasant odour, and a taste which is at first bitter and afterwards sweet. The fluid, when purified by agitation with rectified spirit, and inspissated to the consistence of an extract, constitutes the above purified ox gall. Fresh ox bile contains *glycocholic* and *taurocholic acids in combination with soda*, *cholesterin*, *mucus*, *fat*, and *salts*, &c. It is alkaline. The presence of bile acids is demonstrated by the change of colour under the action of sulphuric acid and sugar. The mucus is removed by agitation with the rectified spirit.

Therapeutics.—Purified ox gall has been recommended in cases of dyspepsia, in which, without organic lesion, there is vomiting after meals; it is given when the secretion of bile is supposed to be deficient. It is more commonly used as an adjunct to aperient pill masses.

It has probably little beneficial effect, and is not much used.

Sevum Præparatum—Prepared Suet.—The internal fat of the abdomen of the sheep, *Ovis Aries*, purified by melting and straining.

Characters.—White, smooth, almost odourless; fusible at 103° F. (39°·4 C.). It consists chiefly of stearin.

Therapeutics.—Prepared suet acts as an emollient, and is sometimes used as a substitute for prepared lard; it enters into the ointment of mercury and cantharides plaster.

Adeps Lanæ—Wool Fat.—The purified cholesterin fat of sheeps' wool.

Characters and Tests.—A yellowish tenacious unctuous substance; almost inodorous, with a melting point about 104° F. (40° C.); readily soluble in ether and in chloroform, sparingly soluble in rectified spirit. Ten grains should dissolve almost completely in 14 fluid drachms of boiling ethylic alcohol, the greater part separating in flocks on cooling. Ignited, leaves but a trace of ash. Fifty grains dissolved in 4 fluid drachms of ether, and 2 drops of tincture of phenolphthalein added, should not require more than 2 grain-measures of volumetric solution of soda to produce a permanent red coloration.[1] The solution in chloroform poured gently over the surface of sulphuric acid acquires a purple-red colour.[2] Heated with solution of soda, no ammoniacal odour should be evolved.

[1] Showing it is not too acid from free acids. [2] The cholestol reaction.

Official Preparation.—Adeps Lanæ Hydrosus.

ADEPS LANÆ HYDROSUS—Hydrous Wool Fat—Lanoline (the name "Lanoline" is a registered trade mark in the United Kingdom).—*Take of wool fat*, 7 *ounces; distilled water*, 3 *ounces. Melt the wool fat in a warm mortar, stirring in the water gradually and thoroughly.*

Characters and Tests.—Yellowish-white, free from rancid odour. When heated, it separates into an upper oily and a lower aqueous layer. 100 grains, exposed over a water-bath until the weight is constant, yields not less than 70 grains, which should answer to the tests for wool fat.

Used in making *Unguentum Conii.*

Composition.—Wool fat is a degenerative product of the keratinous tissues, and consists of the fatty acids—oleic, palmitic, stearic—combined with *Cholesterin*, $C_{26}H_{44}O$, and *Isocholesterin*, these bodies occupying the place of glyceryl in the ordinary fats. It is not so easily saponified as ordinary fats are, the saponification occurring only after heating it with an alcoholic solution of potash, or with caustic potash itself. This stability is the reason why it does not become rancid. The pure fat is too tenacious for use, but it readily absorbs water even up to its own weight, and then becomes softer and more oleaginous in consistence.

Therapeutics.—It is largely used as an emollient and ointment basis, the hydrous wool fat being employed for these purposes. It is said to be more readily absorbed than other fats, but this is doubtful, and it has perhaps a tendency to become too dry. It is perfectly unirritating when pure, but when impure will cause as much irritation as rancid fats do.

Adeps Præparatus — Prepared Lard (Syn. *Axungia*). — The purified fat of the hog, *Sus scrofa.*

PREPARATION.—*Take of the internal fat of the abdomen of the hog, perfectly fresh, any convenient quantity. Remove as much of the membranes as possible, and suspend the fat so that it shall be freely exposed to the air for some hours; cut into small pieces, and beat these in a stone mortar until they are reduced to a uniform mass, in which the membranous vesicles are completely broken. Then put it into a vessel surrounded by warm water, and keep it at a temperature not over* 130° *F.* (54°·4 *C.*), *until it becomes clear and entirely free from the membranous matter; finally strain it through flannel.*

Characters and Tests.—A soft white fatty substance, melting at about 100° F. (37°·8 C.). Has no rancid odour; dissolves entirely in ether. Distilled water in which it has been boiled, when cooled and filtered, gives no precipitate with nitrate of silver,[1] and is not rendered blue by the addition of solution of iodine.[2]

[1] Absence of salt, and [2] starch.

Official Preparations.

Adeps Benzoatus.
Unguentum Simplex.

Also present in *Emplastrum Cantharidis; Unguentum Hydrargyri,—Hydrargyri Nitratis,—Iodi,—Terebinthinæ.*

ADEPS BENZOATUS—BENZOATED LARD.—*Take of prepared lard,* 1 *pound; benzoin, reduced to coarse powder,* 140 *grains. Melt the lard by the heat of a water-bath, add the benzoin, and frequently stirring them together, continue the application of heat for two hours; finally remove the residual benzoin by straining.*

Present in *Unguentum Aconitinæ,—Atropinæ,—Belladonnæ,—Calaminæ,—Chrysarobini,—Gallæ,—Hydrargyri Subschloridi,—Iodoformi,—Plumbi Acetatis,—Potassii Iodidi,—Sabinæ,—Simplex,—Staphisagriæ,—Sulphuris,—Zinci.*

UNGUENTUM SIMPLEX—SIMPLE OINTMENT.—*Take of white wax, 2 ounces; prepared lard, 3 ounces; almond oil, 3 fluid ounces. Melt the wax and the lard in the oil on a water-bath; then remove the mixture, and stir constantly while it cools.*

Contained in *Unguentum Antimonii Tartarati,—Creasoti,—Elemi, —Hydrargyri Ammoniati,—Hydrargyri Iodidi Rubri,—Plumbi Carbonatis,—Plumbi Iodidi,—Resinæ.*

Prepared lard is used externally as an emollient; it forms the basis of many of the official ointments. Simple ointment is employed as an emollient, and as an ointment basis. Lard contains about 50 or 60 per cent. olein, with palmitin and stearin.

Cetaceum—Spermaceti.—A concrete fatty substance, obtained mixed with oil, from the head of the Sperm Whale, *Physeter macrocephalus.* It is separated from the oil by filtration and pressure, and afterwards purified.

Characters.—Crystalline, pearly-white, glistening, translucent, with little taste or odour, reducible to powder by the addition of a little rectified spirit. Scarcely unctuous to the touch. Insoluble in water, soluble in ether, chloroform, or boiling rectified spirit. Melting point 111° to 122° F. (43°·9 to 50° C.), when tested by the method described under Cera Flava.

Composition.—It consists of *Cetin*, $C_{16}H_{33}\cdot C_{16}H_{31}O_2$, which is *palmitate of cetyl.* When saponified it yields *Ethal* (hydrate of cetyl).

Official Preparation.—Unguentum, 1 in 5½.

UNGUENTUM CETACEI—OINTMENT OF SPERMACETI.—*Take of spermaceti, 5 ounces; white wax, 2 ounces; almond oil, 1 pint; benzoin, in coarse powder, ½ ounce. Melt together the spermaceti, wax, aud almond oil; add the benzoin, and, frequently stirring the mixture, continue the application of heat for 2 hours; then remove the residual benzoin by straining, and stir constantly until quite cold.*

Adulteration.—Sometimes stearic acid is added.

Gelatinum—Gelatine.—The air-dried product of the action of boiling water on gelatigenous animal tissues, such as skin, tendons, ligaments, and bones.

Characters.—In translucent sheets or shreds. The solution in hot water is colourless and odourless, and solidifies to a jelly on cooling. Gelatine is insoluble in alcohol and ether. It dissolves in acetic acid. Its aqueous solution is not precipitated by diluted acids, alum, acetate of lead, or perchloride of iron; it is precipitated by tannin. Used in making *Suppositoria Glycerini.*

Therapeutics.—It is used as a basis for nasal, aural, and urethral bougies, and for pessaries and lozenges, the mass being made up much in the same way as the glycerine suppository. It is employed, too, in applying medicines to the skin in skin diseases, a solid basis being made with gelatine (2 parts), water (8 parts), and glycerine (6 parts). This mixture can easily be liquefied by placing the vessel in which it is contained in hot water, and then the medicinal substance can be stirred into it. It is applied with a brush while liquid, and hardens on the skin.

Gelatine is also employed as a basis for making jellies and shapes, &c., and is a largely used article of diet. Although it contains much nitrogen, this is not in a form which can be used by the organism to repair or make good the waste of albuminous tissues in the body. On the other hand, it lessens the oxidation and splitting up of albumins and fats, and is readily oxidised itself; it furnishes heat and energy, and acts indirectly as a nutritive agent by causing the consumption of the body albumins and fats to be decreased.

Pepsin—Pepsin.—A preparation of the mucous lining of the fresh and healthy stomach of the pig, sheep, or calf.

PREPARATION.—*The stomach of one of these animals, recently killed, having been cut open and laid on a board with the inner surface upwards, any adhering portions of food, dirt, or other impurity are to be removed, and the exposed surface slightly and rapidly washed with cold water; the cleansed mucous membrane is then to be scraped with a blunt knife or other suitable instrument, and the viscid pulp thus obtained is to be immediately spread over the surface of glass or glazed earthenware, and quickly dried at a temperature not exceeding* 100° *F.* (37°·8 *C.*). *The dried residue is to be reduced to powder, and preserved in a stoppered bottle.*[1]

Characters and Tests.—A light yellowish-brown powder, having a faint but not disagreeable odour, and a slightly saline taste, without any indication of putrescence. Very little soluble in water or spirit. Two grains of it, with an ounce of distilled water, to which 5 minims of hydrochloric acid have been added, form a mixture in which at least 100 grains of hard-boiled white of egg, passed through wire gauze of 36 meshes per linear inch, and made of No. 32 brass or copper wire, will dissolve on their being well mixed, digested, and well stirred together for 30 minutes at a temperature of 130° F. (54°·4 C.).[2]

Dose.—2 to 5 grains.

[1] Pepsin is prepared in many other ways; this method removes a quantity of mucous cells, mucus, and epithelium at the same time.

[2] It converts the albumin into albumoses and peptones, which are soluble in water.

Therapeutics.—Pepsin is given in cases of chronic dyspepsia as an aid to digestion, either alone or with hydrochloric acid. It has to a considerable extent disappointed the high expectations originally formed as to its probable value in gastric indigestion. Many practitioners prefer fluid preparations in which the pepsin is held dissolved in glycerine with very weak spirit.

Samples of pepsin vary much in strength, but they should at least conform to the B.P. test.

Pancreatic Preparations—(*not official*).—The pancreatic ferments are several in number, and are prepared from the pancreas of animals, either in the form of an impure powder or as liquid preparations. These ferments act only in an alkaline medium, and convert albumin into peptones, starches into sugar, split up fats, and curdle milk.

Many different preparations are obtainable, the dose and directions for use being generally stated on the bottle or packet. They are used in dyspepsia and to make peptonised foods, and are probably much more efficacious than pepsin.

Keratin—Keratin—(*not official*).—Horn shavings are treated with artificial gastric juice until they yield nothing further to it, the albuminous substances being hereby dissolved out. The residue is then dissolved in ammonia solution, and when the latter is evaporated off, a gum-like substance is left. It is used as a coating for pills which are desired to pass through the stomach unchanged. The gastric juice does not act on the keratin, but the latter dissolves at once in the alkaline duodenum.

Class AVES.

Albumen Ovi—Egg Albumen.—The Liquid White of the Egg of *Gallus Bankiva*, var. *domesticus.*

The white of an egg weighs about $\frac{1}{2}$ to $\frac{3}{4}$ ounce. It contains about 88 per cent. *water*, and 12 to 18 per cent. *solids*, chiefly *albumin*, traces of *fat*, and many *salts.*

The liquid albumin (white) of egg is employed as a demulcent and protecting agent in corrosive and irritant poisoning, and especially as an antidote in poisoning by corrosive sublimate, sulphate of copper, and other metallic irritants. Beat up in skimmed milk, it is often found to be retained by the stomach when the irritable condition of that organ will not tolerate anything else. It is also used as a test, dissolved in water and filtered.

Ovi Vitellus—Yolk of Egg.—The Yolk of the Egg of *Gallus Bankiva*, var. *domesticus.*

It contains about 50 per cent. water, 16 per cent. of a proteid body, *Vitellin*, a large quantity of *fat* (about 30 per cent.), traces of many *inorganic salts, lecithin, yellow colouring matter, sugar,* &c.

It is nutritious; is employed in making *Mistura Spiritus Vini Gallici*, and in the formation of various emulsions with oily medicines, such as copaiba, oil of turpentine, &c.

Class PISCES.

Oleum Morrhuæ—Cod-liver Oil—Oleum Jecoris Aselli—The oil extracted from the fresh liver of the cod, *Gadus Morrhua*, by the application of a heat not exceeding 180° F. (82°·7 C.).

Characters and Test.—Pale yellow, with a slight fishy odour, and bland fishy taste. A drop of sulphuric acid added to a few drops of the oil on a porcelain slab develops a violet colour, which soon passes to a yellowish- or brownish-red.[1]

Dose.—1 to 8 fluid drachms.

The oil is obtained from the livers of other fishes, but chiefly from that of the cod. It is largely manufactured in Newfoundland and in the north of Europe, and also to a considerable extent in this country. It is prepared in a variety of ways, as by exposing the livers to the influence of the sun and the atmosphere for a considerable time, whereby they undergo putrefaction, and yield their oil spontaneously; or by simply cutting them in pieces and allowing the oil to drain from them; or by heating them in boilers and skimming off the oil as it rises to the surface; or, as is commonly practised in this country, by carefully selecting perfectly fresh, clean, and good livers, washing them, and exposing them to a steam heat not exceeding 180° F. The oil which rises to the surface is filtered, and the temperature reduced to about 50°, in order to congeal the solid fat (palmitin and stearin); this is removed by a second filtration, and the oil is then preserved in air-tight jars. Three varieties of the oil are met with in commerce, *pale-yellow*, *pale-brown*, and *dark-brown;* and of these the dark oil is the most offensive. All the varieties have a peculiar, and at first an offensive, taste and odour, but the pale yellow kind, which alone is official, is least offensive.

Constituents.—It consists largely of *Olein*, along with some *Palmitin* and *Stearin.* Small amounts of *Iodine*, *Bromine*, *Chlorine*, *Phosphorus*, *Sulphur*, and *biliary substances* are present. Various alkaloidal bases, *Aselline*, $C_{25}H_{32}N_4$; *Morrhuine*, $C_{19}H_{27}N_3$, and others, have been found in it. The former is an amorphous solid, the latter a liquid.

[1] Presence of bile acids simply shows that it is liver-oil. The oil is soluble 1 in 2 ether, sparingly in absolute alcohol. Old specimens become rancid and acid.

EMULSIO OLEI MORRHUÆ—EMULSION OF COD-LIVER OIL, B.P.C. (*not official*).—*Take of cod-liver oil,* 8 *fluid ounces; yolks of two eggs; tragacanth, in powder,* 16 *grains; elixir of saccharin, simple tincture of benzoin, of each* 1 *fluid drachm; spirit of chloroform,* 4 *fluid drachms; essential oil of bitter almonds,* 8 *minims; distilled water sufficient to produce* 16 *fluid ounces. Measure* 5 *fluid ounces of the distilled water, place the tragacanth, in powder, in a dry mortar, and triturate with a little of the cod-liver oil; then add the yolks, and stir briskly, adding water as the mixture thickens. When of a suitable consistence, add the remainder of the oil and water alternately, with constant stirring, avoiding frothing. Transfer to a pint bottle, add the elixir of saccharin, tincture of benzoin, spirit of chloroform, and oil of almonds, previously mixed; shake well, and add distilled water, if necessary, to make the product measure* 16 *fluid ounces.*

Dose.—2 to 8 fluid drachms.

Therapeutics.—Cod-liver oil is more easily digested and assimilated than most other fats, and hence is superior to them in cases where one desires to store up fat in the body. It has been asserted that the alkaloids in the oil are stimulant and alterative, and improve general nutrition, and that the oil owes its superiority to them, while the iodine, bromine, and biliary compounds have also been claimed as having a beneficial effect. It is largely used as a fattening and alterative food in phthisis and all forms of tuberculosis of bones, joints, glands, &c. In none of these has it any specific curative effect; but it strengthens the patient, and increases the resisting and recuperative power of the tissues. In rheumatism, chronic skin diseases, emaciation, chronic bronchitis, neuralgia, and many other conditions of depressed nutrition, it is of extreme value.

It should be taken immediately after meals, so as not to spoil the appetite. It is generally disliked at first; in some cases the repugnance is readily overcome, in others never. It is best to begin with a small quantity, and gradually increase the amount. It is often better tolerated in emulsion, for which there are many formulæ, or along with extract of malt; but many people take it best alone. Sometimes, in children, it is given by inunction.

Isinglass.—The swimming bladder or sound of various species of *Acipenser*, Linn., prepared and cut into fine shreds. Isinglass is placed in the Appendix of the Pharmacopœia, for the preparation of a test solution, by means of which tannic acid may be distinguished and separated from gallic acid, the former giving with it a yellowish-white precipitate.

CLASS INSECTA.

Cantharis—Cantharides.—The beetle, *Cantharis vesicatoria*, dried; collected in Russia, Sicily, and Hungary.

Characters.—From $\frac{3}{4}$ to 1 inch long, and $\frac{1}{4}$ inch broad, furnished with two long elytra or wing-sheaths of a shining coppery-green colour, under which are two membranous transparent wings; odour strong and disagreeable; powder greyish-brown, containing shining green particles.

The Blister Beetle or Spanish Fly is an inhabitant of southern Europe, especially Italy and Spain, and is also met with in France, Russia, Siberia, Germany, Hungary, and elsewhere, those which are now brought to this country being collected chiefly in Russia, Sicily, and Hungary. The insects are found feeding upon the leaves of certain species of *Oleaceæ*, as the ash, privet, and lilac, and of *Caprifoliaceæ*, as the elder and honeysuckle. They are collected in the months of May and June, either in the morning or the evening, when they are less alert. Cloths are spread under the trees, which are then either shaken or beaten by persons whose faces and hands are protected; the insects fall into the cloths and are immediately killed, either by the vapour of vinegar, or by placing them in air-tight vessels, with or without a little oil of turpentine, or by immersing the cloths containing them in hot vinegar and water, or by other means, and they are then dried. Cantharides are liable to the attack of mites and other insects, and in order to preserve them, they are to be kept in well-stoppered bottles or air-tight boxes, in which a few drops of strong acetic acid, or a little camphor or other preservative is placed. The beetle is usually called Spanish Fly; from the specific name *Lytta vesicatoria* (Fabricius) the word Lytta is frequently employed in prescribing its preparations.

Active Principles.—Cantharidin, $C_{10}H_{12}O_4$ (about $\frac{1}{2}$ per cent.), in colourless crystals, soluble in alcohol, ether, chloroform, fats, glacial acetic acid, and water. *Fats, various extractives, &c., ash*, about 6 per cent.; moisture about 10 per cent.

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Acetum.	Cantharides bruised.	1 in 20.	...
Charta Epispastica.	„ powder.	1 in $15\frac{1}{2}$.	...
Collodium Vesicans.	Liquor Epispasticus.	1 in 1.	...
Emplastrum Calefaciens.	Cantharides coarse powder.	1 in 30.	...
Emplastrum Cantharidis.	„ powder.	1 in 3.	...
Liquor Epispasticus.	„ „	1 in 4.	...
Tinctura.	„ coarse powder.	1 in 80.	5 to 20 mins.
Unguentum.	„ powder.	1 in 8.	...

ACETUM CANTHARIDIS — VINEGAR OF CANTHARIDES. — *Take of cantharides, bruised,* 2 *ounces; glacial acetic acid,* 2 *fluid ounces; acetic acid, sufficient for* 20 *fluid ounces. Mix* 13 *fluid ounces of the acetic acid with the glacial acetic acid, and digest the cantharides in this mixture for two hours at a temperature of* 200° *F.* (93°·3 *C.*)*; then transfer the ingredients, after they have cooled, to a percolator, and when the liquid ceases to pass, pour* 5 *fluid ounces of acetic acid over the residuum in the apparatus. As soon as the percolation is complete, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient acetic acid to make* 1 *pint. Specific gravity, about* 1·060.

This preparation contains eight times as much cantharides as the tincture. It is a prompt vesicant, but too strong for internal use.

CHARTA EPISPASTICA—BLISTERING PAPER.—*Take of white wax,* 4 *ounces; spermaceti,* $1\frac{1}{2}$ *ounce; olive oil,* 2 *fluid ounces; resin,* $\frac{3}{4}$ *ounce; Canada balsam,* $\frac{1}{4}$ *ounce; cantharides, in powder,* 1 *ounce; distilled water,* 6 *fluid ounces. Digest all the ingredients, excepting the Canada balsam, in a water-bath for two hours, stirring them constantly, then strain, and separate the plaster from the watery liquid. Mix the Canada balsam with the plaster melted in a shallow vessel, and pass strips of paper over the surface of the hot liquid, so that one surface of the paper shall receive a thin coating of plaster. It may be convenient to employ ruled paper, so as to indicate divisions of one square inch.*

COLLODIUM VESICANS — BLISTERING COLLODION.— *Take of blistering liquid,* 20 *fluid ounces; pyroxylin,* 1 *ounce. Add the pyroxylin to the liquid in a stoppered bottle, and shake them together until the former is dissolved.*

EMPLASTRUM CALEFACIENS—WARMING PLASTER—WARM PLASTER.—*Take of cantharides, in coarse powder; expressed oil of nutmeg; yellow wax; resin, of each,* 4 *ounces; soap plaster,* $2\frac{1}{4}$ *pounds; resin plaster,* $3\frac{1}{4}$ *pounds; boiling water,* 1 *pint. Infuse the cantharides in the boiling water for six hours; squeeze strongly through calico, and evaporate the expressed liquid by a water-bath, till reduced to one-third. Then add the other ingredients, and melt in a water-bath, stirring well until the whole is thoroughly mixed.*

EMPLASTRUM CANTHARIDIS—CANTHARIDES PLASTER.—*Take of cantharides, in powder,* 12 *ounces; yellow wax, prepared suet, of each,* $7\frac{1}{2}$ *ounces; resin,* 3 *ounces; prepared lard,* 6 *ounces. Liquefy the wax, suet, and lard together by a water-bath, and add the resin, previously melted; then introduce the cantharides, mix the whole thoroughly, and continue to stir the mixture while it is allowed to cool.*

LIQUOR EPISPASTICUS — BLISTERING LIQUID (*Synonym:* Linimentum Cantharidis).—*Take of cantharides, in powder,* 5 *ounces; acetic ether, a sufficiency. Mix the cantharides with* 3 *fluid ounces of acetic ether; pack them in a percolator, and at the expiration of twenty-four hours, pour acetic ether over the contents of the percolator, and allow it to pass slowly through till* 20 *fluid ounces are obtained. Keep it in a stoppered bottle.*

TINCTURA CANTHARIDIS—TINCTURE OF CANTHARIDES.—*Take of cantharides, in coarse powder,* $\frac{1}{4}$ *ounce; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make* 1 *pint.*

UNGUENTUM CANTHARIDIS—OINTMENT OF CANTHARIDES.—*Take of cantharides, yellow wax, of each* 1 *ounce; olive oil,* 6 *fluid ounces. Infuse the cantharides in the oil, in a covered vessel, for twelve hours, then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the wax, previously melted, and stir constantly while the mixture cools.*

Therapeutics.—Cantharides act in over-doses as a powerful irritant poison, causing inflammation of the mucous membrane of the alimentary canal, attended by severe pain, vomiting, and purging with bloody discharges. In medicinal doses, cantharides act chiefly upon the genito-urinary organs, stimulating the parts, and causing an increased flow of urine ; in over-doses, and in some persons in small doses, or even when applied externally only, they are apt to produce strangury. They have been employed as diuretics, and have been recommended also in incontinence of urine from paralysis of the bladder, in the incontinence of urine of children, in gleet, in leucorrhœa, &c. ; but their use internally requires great caution, and they are contra-indicated both internally and externally in acute inflammatory and irritable states of the genito-urinary organs. They are said to increase sexual desire, and have been secretly given for that purpose—a dangerous practice, for, according to Christison, poisonous doses are required to produce the effect.

Cantharides are commonly used as external local irritants, for the purpose of rubefaction or vesication. They are employed as counter-irritants, derivatives, and local stimulants, in the vast number of cases in which such treatment is indicated. The plaster of cantharides (fly blister or rising blister) is frequently employed ; it is, for these purposes, usually kept on from eight to twelve hours, after which it is removed, the vesicle is clipped at its most depending margin, and the part is dressed with any bland fatty substance, or the cuticle may be removed altogether, and the surface be dressed with a thick layer of raw cotton, beneath which it heals rapidly. When prolonged counter-irritation is desired, the part is dressed with the ointment of cantharides, ointment of savin, or other irritant. Sometimes the cantharides plaster is only allowed to remain on for five or six hours, vesication being promoted by the subsequent application of a poultice. Caution is necessary in the application of blisters to children, to aged and debilitated persons, and to persons with a particularly sensitive skin, as sloughs may form. The charta epispastica is in effect similar to the emplastrum cantharidis. Warm plaster is used as a stimulant and rubefacient. Liquor epispasticus is used as a prompt vesicant in cases in which rapidity of action is required, or in which either the nature of the part to be affected or the condition of the patient is unsuited to the plaster ; it is sometimes used in ringworm with success. It is applied by means of a camel's-hair brush, two or three coatings being given when prompt action is required ; when scantily applied, it acts as a rubefacient. The acetum may be used for vesication also. Ointment of cantharides is used as a counter-irritant, and as an irritant dressing to blistered surfaces, issues, ulcers, &c.

Treatment of Poisoning.—Empty stomach ; mucilaginous and demulcent drinks ; warm applications externally, and opiates internally, to allay pain.

Mylabris cichorii and **M. phalerata**—Chinese Blistering Flies. —Beetles indigenous to Southern and Eastern Asia. Black, wing-cases with two bands, and at the base two spots, these being orange-yellow in colour.

Mylabris bifascialis (S. Africa), *Cantharis vittata* (U.S.), the potato fly, are also black, with yellowish bands and spots. They all contain *Cantharidin*, and are similar in action and effects to the Spanish Fly.

Mel—Honey.—A saccharine secretion deposited by *Apis mellifica*, the Hive Bee or Honey Bee, in the honeycomb; British and imported.

Characters.—When recently separated from the honeycomb, it is a viscid translucent liquid, of a brownish-yellow colour, which gradually becomes partially crystalline[1] and opaque. It has a peculiar heavy odour, and a very sweet taste.

Boiled with water for five minutes, and allowed to cool, it does not become blue with the solution of iodine.[2] Incinerated it should not yield more than 0·2 per cent. ash,[3] the solution of which in water acidulated with nitric acid should not afford more than a slight turbidity with solution of chloride of barium.[4]

Constituents.—*Grape sugar* (dextrose), *fruit sugar* (levulose), a little *wax, volatile oil, mucilage, colouring matter, ash* (0·1 to 0·3 per cent.).

[1] The grape sugar crystallises, the fruit sugar does not. [2] Absence of starch. [3] More ash indicates adulterations with glucose, &c. [4] Absence of sulphates.

Official Preparation—Mel Depuratum.

MEL DEPURATUM — CLARIFIED HONEY. — *Take of honey,* 5 *pounds. Melt the honey in a water-bath, and strain, while hot, through flannel, previously moistened with warm water.*

It is present in *Confectio Piperis* (1 in $1\frac{1}{3}$)—*Scammonii* (1 in 6, nearly)—*Terebinthinæ* (1 in 2 nearly) ; *Mel Boracis* (8 in 9 nearly) ; *Oxymel* (1 in $1\frac{1}{4}$) ; *Oxymel Scillæ.*

Therapeutics.—Honey acts as an emollient, demulcent, and laxative. It is employed as a vehicle for other medicines ; but it is much more commonly used as an article of diet, and with some persons, when so taken, it serves the purpose of a laxative. Fresh honey may cause griping pains and indigestion, and poisonous effects have followed its use when obtained by the bees from deleterious plants.

Adulterations.—*Starch, glucose, sugar, salts of alkalies,* and other substances are occasionally added.

Cera Flava—Yellow Wax.—The prepared honeycomb of the Hive Bee, *Apis mellifica;* British and imported.

Characters and Tests.—Firm, breaking with a granular fracture, yellow, having an agreeable honey-like odour. Not unctuous to the touch.[1] Readily and entirely soluble in hot oil of turpentine. Should not yield more than 3 per cent. to cold rectified spirit,[2] and nothing to water, or to a boiling solution of soda, the two latter fluids after filtration neither being turbid, nor yielding a precipitate on the addition of hydrochloric acid, [1, 2]. Specific gravity, ·095 to 0·97.[3] Melts at 146° F. (63°·3 C.),[3] when tested as follows:—Liquefy a few grains, and draw a little of the fluid up into a capillary tube; fix a piece of the filled capillary tube to the bulb of a thermometer by thread; immerse in a beaker of water, and heat the latter gently; at the moment the opaque rod of wax becomes transparent, note the temperature. The solidifying point is 2 to 3 degrees lower than the melting point. Boiling water in which it has been agitated is not, when cooled, rendered blue by iodine.

Composition. — It consists of *Myricin* (palmitate of myricyl), $C_{30}H_{61}.C_{16}H_{31}O_2$, about 80 per cent., crystalline, slightly soluble in hot alcohol, soluble in hot ether; and of *Cerin* (cerotic acid), $C_{27}H_{54}O_2$, about 10 to 20 per cent., also in crystals if pure. Small quantities of *other allied bodies*, *colouring* and *aromatic matters*.

[1] Absence of added fats. [2] Absence of resins. [3] Absence of fats and other adulterants.

Yellow wax is contained in *Emplastrum Calefaciens,—Cantharidis,—Galbani,—Picis,—Saponis Fuscum; Pilula Phosphori; Unguentum Cantharidis,—Hydrargyri Compositum,—Picis Liquidæ,—Resinæ,—Sabinæ,—Terebinthinæ.*

Cera Alba—White Wax.—Yellow Wax, bleached by exposure to moisture, air, and light; British and imported.

Characters and Tests.—Hard, nearly white, translucent. It should respond to the tests for yellow wax.

It is contained in *Charta Epispastica*, *Unguentum Cetacei*, and *Unguentum Simplex.*

Therapeutics.—Is used externally as an emollient and protective. It gives consistence to ointments, those containing a large amount being sometimes called cerates.

Adulterations.—Tallow, paraffin, resin, starch, and *mineral substances* are detected by the B.P. tests.

Coccus — Cochineal. — The female insect, *Coccus Cacti*, dried; reared on *Opuntia cochinillifera* and other species of *Opuntia.*

Characters.—Ovate, plano-convex, about two lines long, wrinkled, black, or greyish-white; [1] yields, when crushed, a puce-coloured powder. The greyish-white insect quickly becomes black when warmed before the fire.[2] When macerated in water no insoluble powder is separated.[3] Ash not more than 1 per cent.[4]

In Mexico, Vera Cruz, the Canary Islands, Algeria, and other parts whence the cochineal insects are obtained, large plantations of the Nopal (*Opuntia cochinillifera*) are cultivated for them to feed upon. The insects are carefully reared, and the females are placed upon the cactus tree to bring forth their young. When they arrive at a proper age, and the young female insects have become fecundated, the collection takes place, the insects being swept off the trees and destroyed by immersion in boiling water, and then dried.

Constituents.—About 10 per cent. of a brilliant *red colouring matter*, amorphous, soluble in alkalies, alcohol, and water; *wax, fat, &c.; moisture* about 6 per cent.

Carmine is the precipitate obtained by boiling cochineal with alum or cream of tartar; it contains 50 or 60 per cent. of red colouring matter, with other constituents.

[1] This is due to the dried waxy matter on the surface of the insect. [2] From melting of the waxy coating. [3] Absence of inorganic powders added to make surface greyish or black (see Adulterations). [4] It is often more than this.

Official Preparation.

Tinctura, . . . 1 in 8.

Cochineal is also contained in *Tinctura Cardamomi Composita* and —*Cinchonæ Composita.*

TINCTURA COCCI—Tincture of Cochineal.—*Take of cochineal, in powder,* $2\frac{1}{2}$ *ounces; proof spirit,* 1 *pint. Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient proof spirit to make* 1 *pint.*

Therapeutics.—Cochineal was formerly employed as an anodyne and antispasmodic, and was used in neuralgia, whooping-cough, &c.; but it is now used only as a colouring adjunct to other medicines.

Adulterations.—The silver-grey colour may be imitated with carbonate and sulphate of barium or lead; the black colour with plumbago, manganese dioxide, &c.

Granilla is an inferior kind of cochineal, and consists of smaller and uncultivated insects.

Class Mollusca.

Sepia officinalis—Cuttle-fish.—It is a cephalopod found in the Mediterranean and Atlantic.

The so-called bone (os sepiæ) of the cuttle-fish is used chiefly in tooth-powders. It is white, oval, about 4 inches long, both sides convex; smooth and hard externally, porous and friable internally; no odour; taste earthy, and rather saline.

It consists chiefly of calcium carbonate with phosphates of calcium and magnesium, sodium chloride, and other salts in small amount, with 10 to 15 per cent. animal matter.

Class Annelida.

Hirudo—The Leech.—1. *Sanguisuga medicinalis*, Savigny, the Speckled Leech; and 2. *S. officinalis*, Sav., the Green Leech; collected in Spain, France, Italy, and Hungary.

Characters.—Body soft, smooth, elongated, 2 or 3 inches long, tapering to each end, plano-convex, wrinkled transversely; back olive-green, with six rusty-red longitudinal stripes. 1. Belly greenish-yellow, spotted with black; 2. belly olive-green, not spotted.

The body of the leech is plano-convex, being round on the dorsal, and flat on the ventral aspect. It tapers towards each end, and is annulated, being composed of seventy to a hundred soft rings of gelatinous consistence. The mouth is triradiate, and is furnished with three jaws, each of which is armed with two rows of teeth. The opposite extremity is furnished with a flattened disc or sucker, which, when attached, serves as a fulcrum for the purposes of locomotion.

Leeches abstract from a drachm to half an ounce of blood, according to the kind employed, and their condition at the time, the average loss of blood by each leech, including the subsequent hæmorrhage, being about half an ounce. They contain a ferment which hinders coagulation of the blood, and hence the tendency of leech-bites to prolonged bleeding. Leeches often refuse to bite, and it sometimes requires considerable tact and patience in order to succeed with them. To secure their application, the part to which they are to be applied should be carefully washed, taking care to remove all trace of soap, and, if necessary, a little cream or milk may be smeared upon the skin, or a slight puncture may be made with the point of a lancet, so as to tempt them with the taste of blood. The leeches themselves should be taken out of cold water, and gently squeezed in a dry cloth. When it is desirable that a leech should attach itself to a particular spot, it may be directed to it either by means of a glass tube or *leech-glass*, or by placing upon the part a piece of blotting-paper, with a hole in it corresponding to the point to be attacked. The atmosphere of the apartment should be cool and pure ; for should it be close, over-heated, or loaded with tobacco smoke or other fumes, the leeches will probably not bite. When the healthy leech has gorged itself it will drop off ; but if it be desirable to remove it sooner, a drop of water, or a grain or two of sugar or of salt, may be sprinkled upon its head. If it be desirable to take more blood than the leeches can abstract, warm poultices may be applied to the part. In order to arrest the hæmorrhage from leech-bites, the wounds should be exposed to the air ; if that be insufficient, pressure may be made upon them with the points of the fingers, or by pledgets of lint and a bandage ; or styptics, such as matico, alum, or tannin, may be applied ; or a sharp point of lunar caustic may be inserted for an instant. When these measures fail, the part should be transfixed with a needle and tied. When leeches are to be applied to any of the orifices of the body, great care must be taken to prevent their escape beyond reach. Should a leech be swallowed, port wine or common salt should be given, followed as promptly as possible by an emetic. In the case of a leech escaping into the rectum, an enema of port wine or common salt should be administered. Great care and discrimination is required in the application of leeches to children, and to adults also under certain circumstances. A child should never be put to bed at night until hæmorrhage from the leech-bites is thoroughly stopped. When many leeches are applied to a part, they should be carefully counted after their removal, otherwise one or two, which may not have taken well, may get astray, and cause unpleasant consequences by attacking children or others during sleep. Leeches are employed for the purposes of local depletion, but they act also as derivatives. There are many cases in which the abstraction of a comparatively small quantity of blood by leeches will afford relief which could not be procured by general blood-letting.

DIVISION III.—CHEMICAL PRODUCTS, PRODUCTS OF FERMENTATION, OF DESTRUCTIVE DISTILLATION, FOSSIL VEGETABLE PRODUCTS, &c.

Alcohol, $C_2H_5.HO$.—Pure alcohol, more or less dilute, is contained in the Pharmacopœia under the names *Alcohol Ethylicum*, *Spiritus Rectificatus*, and *Spiritus Tenuior.* It is also official as *Spiritus Vini Gallici*, *Vinum Xericum*, and *Vinum Aurantii*, besides being used as a menstruum in a very large number of other preparations.

Alcohol is obtained from sugar, and from any substance which is capable of being converted into grape-sugar, by *vinous fermentation;* it is chiefly made from grape-juice, many cereals, beet, potatoes, &c., all of which yield sugar directly or indirectly. Pure sugar dissolved in water does not undergo the change necessary to produce alcohol without the presence of the yeast ferment. When grape or cane sugar is dissolved in water, and maintained at a temperature of from 60° to 80° F. in the presence of yeast, a change takes place: effervescence is observed, and when this has ceased, it is found that the fluid no longer contains sugar, but alcohol is present, carbonic-acid gas having escaped. The sugar is resolved into alcohol and carbonic-acid gas (along with numerous other bye-products), the ferment neither adding to nor abstracting from its constituents; grape-sugar splits up thus, $C_6H_{12}O_6=2C_2H_6O+2CO_2$, under the action of the ferment. In the case of cane-sugar, an atom of water requires, in the first instance, to be assimilated, by which means it is converted into grape-sugar, and the fermentation goes on as before; thus, $C_{12}H_{22}O_{11}+H_2O=2C_6H_{12}O_6$, and then $C_6H_{12}O_6=2CO_2+2C_2H_6O$. From the fermented fluids the spirit is obtained by distillation and rectification. The strength of the spirit is shown by its density.

The stronger wines (Sherry, Port, Madeira) contain from about 16 to 20 per cent. of *alcohol*, more or less *grape-sugar*, *colouring matter*, and *salts*. The flavour and distinctive bouquet are due to small quantities of *ethers*. The weaker wines (Claret, Burgundy, Hock) contain about 7 to 14 per cent. *alcohol;* Champagne about 8 to 14 per cent.; Spirits (Whisky, Gin, Brandy, Rum) about 45 to 55 per cent., with different ethereal bodies. Light beers contain about 3 per cent., strong beers 6 or 7 per cent., and porter 6 to 10 per cent.

alcohol. Malt liquors contain diastase and carbohydrates, and are hence of considerable nutritive value, apart from the alcohol.

ALCOHOL ETHYLICUM—ETHYLIC ALCOHOL, $C_2H_5.HO$.—*Take of rectified spirit,* 1 *pint; carbonate of potassium, anhydrous,* 1½ *ounce; chloride of calcium, fused, a sufficiency; slaked lime,* 10 *ounces. Put the carbonate of potash and spirit into a stoppered bottle, and allow them to remain in contact for* 24 *hours, frequently shaking the bottle. Expose the calcium chloride to a red heat in a covered crucible for half an hour, then pour the fused salt on to a clean stone slab, cover it quickly with an inverted porcelain dish, and when it has congealed, break it up into small fragments, and enclose it in a dry stoppered bottle. Put one pound of this fused chloride of calcium into a flask, pour over it the spirit decanted from the carbonate of potassium, and closing the mouth of the flask with a cork, shake them together, and allow them to stand for* 24 *hours with repeated agitation. Then attaching a dry condenser closely connected with a receiver, from which free access of air is excluded, and applying the flame of a lamp to the flask, distil about* 2 *fluid ounces, which should be returned to the flask, after which the distillation is to be continued until* 15 *fluid ounces have been recovered.*[1]

Characters and Tests.—Colourless, and free from empyreumatic odour. Specific gravity, 0·797–0·800, and therefore containing 1 or, at most, 2 per cent. of water. It is entirely volatilised by heat, is not rendered turbid when mixed with water, and does not cause anhydrous sulphate of copper to assume a blue colour when well shaken with it.

[1] The object of this process is to remove the water from the rectified spirit, and so convert the latter into absolute alcohol, which is a limpid, colourless, light fluid, exceedingly volatile, producing intense cold during its evaporation, highly inflammable, burning with a pale blue smokeless flame, has a pungent and rather agreeable odour, and a burning acrid taste; it unites with water in all proportions, and by gradually absorbing it from the atmosphere when exposed, it becomes weaker. It has never been frozen. The specific gravity of alcohol affords an indication of its strength and purity; fixed impurities would remain after volatilisation; oily substances would render it turbid on the addition of water; and water, if present, would give rise to a blue colour with anhydrous sulphate of copper. Alcohol is used only as a solvent and test. It is not administered as a medicine, except in so far as it forms the basis of all spirituous liquors.

It is used in making *Chloroform* and *Liquor Sodii Ethylatis.*

SPIRITUS RECTIFICATUS — RECTIFIED SPIRIT. — Alcohol, $C_2H_5.HO$, with 16 per cent. of water; obtained by the distillation of fermented saccharine fluids, and by the rectification of the product, if it be not of the proper density.

Characters and Tests.—Colourless, transparent, very mobile and inflammable, of a peculiar pleasant odour, and a strong spirituous burning taste. Burns with a blue flame without smoke. Specific gravity, 0·838. Remains clear when diluted with distilled water. Odour and taste purely alcoholic. A little rubbed on the back of the hand leaves no unpleasant smell when the spirit has evaporated. Four fluid ounces with 30 grain-measures of the volumetric solution of nitrate of silver exposed for twenty-four hours to bright light, and then decanted from the black powder which has formed, undergoes no further change when again exposed to light with more of the test.

Twenty-two tinctures and most of the spirits in the B.P. are made with rectified spirit.

SPIRITUS TENUIOR—PROOF SPIRIT.—*Take of rectified spirit,* 5 *pints; distilled water,* 3 *pints. Mix. Specific gravity,* 0·920.

It contains, by weight, about 49 per cent., and by volume about 57 per cent., of absolute alcohol.

Forty-four tinctures, besides other preparations in the B.P., are made with proof spirit.

Spiritus Vini Gallici—Spirit of French Wine—French Brandy. —Spirit distilled from French Wine. It has a peculiar flavour and a light sherry colour, derived from the cask in which it has been kept.

Brandy contains about 53 per cent. of *alcohol*, with some *volatile oil* and *œnanthic ether.* It is coloured either by the cask on keeping, or with burnt sugar, being almost colourless when distilled.

Official Preparation.

Mistura, . *Dose*, 1 to 2 fluid ounces.

MISTURA SPIRITUS VINI GALLICI—MIXTURE OF FRENCH BRANDY.

PREPARATION. — *Take of French brandy, cinnamon water, of each,* 4 *fluid ounces; the yolks of* 2 *eggs; refined sugar,* $\frac{1}{2}$ *ounce. Rub the yolks and sugar together, then add the cinnamon water and spirit.*

Vinum Xericum—Sherry.—A Spanish Wine.

Characters.—Pale yellowish-brown, containing about 17 per cent. of alcohol.

Sherry is employed in the preparation of all the official wines except three ; the exceptions are Vinum Aurantii, Vinum Ferri Citratis, and Vinum Quininæ.

Therapeutics.—Alcohol is used externally in evaporating lotions to cause local cold in headache (eau-de-Cologne, lavender water, &c.), orchitis, &c. ; to harden the skin and prevent bedsores, to harden tender nipples, as an ingredient in aromatic antiseptic mouth-washes, and in many other ways. Internally alcohol is used in fevers of an adynamic type—such as typhoid, pneumonia, typhus, small-pox, &c. —where great demands are made on the patient's power of endurance. In these cases it stimulates the heart, lowers the temperature, lessens tissue waste, and by its narcotic action on the nervous system, contributes greatly to the patient's comfort. As a direct food, its nutritive value is comparatively very small, but it is easily absorbed and utilised, and is valuable in enabling other foods to be digested. In sudden fainting, shock, cardiac depression, tobacco, aconite or other depressing poisoning, it stimulates the circulation.

As wine or malt liquor, it is largely used in phthisis, in tuberculosis, in convalescence, and in many wasting diseases, as a valuable adjunct to the dietary.

It acts as a carminative and stimulant to digestion in the slighter forms of dyspepsia ; but large quantities of wine or raw spirits greatly hinder digestion, and tend to irritate the stomach. It renders an insufficient or badly-cooked dietary tolerable, but it itself is an extremely expensive form in which to take carbohydrates, as its direct nutritive value is so small. Healthy people, when well-fed, are able to do the most severe bodily and mental work without alcohol.

Spiritus Methylatus—Methylated Spirit (*not official*).

This is duty-free spirit, allowed by the excise authorities to be sold under special conditions. It consists of alcohol with 10 per cent. wood naphtha added. When supplied to be sold retail, petroleum oil is further added, to make it more nauseous and unfit to drink ; this latter becomes whitish and turbid when mixed with water.

Alcohol Amylicum—Amylic Alcohol—Fusel Oil—Hydrate of Amyl.

Amylic alcohol, $C_5H_{11}.HO$, with a small proportion of other spirituous substances. A liquid of oily consistence, contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification or distillation of such crude spirit. It should be redistilled, and the product passing over at 253° to 260° F. (122°·8 to 126°·17 C.) be alone collected for use.

Characters.—A colourless liquid, with a penetrating and oppressive odour and a burning taste. When pure, its specific gravity is ·818, and its boiling point 270°. Sparingly soluble in water, but soluble in all proportions in alcohol, ether, and essential oils. Exposed to the air in contact with platinum black, it is slowly oxidised, yielding valerianic acid.

It is used in making *Amyl Nitris* and *Sodii Valerianas.*

Chloroformum—Chloroform.

PREPARATION.—*Take of chlorinated lime,* 10 *pounds; rectified spirit,* 30 *fluid ounces; slaked lime, a sufficiency; water,* 3 *gallons; sulphuric acid, a sufficiency; chloride of calcium, in small fragments,* 2 *ounces; distilled water,* 9 *fluid ounces; ethylic alcohol, a sufficiency. Place the water and the spirit in a capacious still, and raise the mixture to the temperature of* 100° *F.* (37°·8 *C.*). *Add the chlorinated lime and* 5 *pounds of the slaked lime, mixing thoroughly. Connect the still with a condensing worm encompassed by cold water, and terminating in a narrow-necked receiver; and apply heat so as to cause distillation, taking care to withdraw the fire the moment that the process is well established. When the distilled product measures* 50 *ounces, the receiver is to be withdrawn. Pour its contents into a gallon-bottle half-filled with water, mix well by shaking, and set at rest for a few minutes, when the mixture will separate into two strata of different densities. Let the lower stratum, which constitutes crude chloroform, be washed by agitating it in a bottle with* 3 *ounces of the distilled water. Allow the chloroform to subside, withdraw the water, and repeat the washing with the rest of the distilled water in successive quantities of* 3 *ounces at a time. Agitate the washed chloroform for five minutes in a bottle with an equal volume of sulphuric acid, allow the mixture to settle, and transfer the upper stratum of liquid to a flask containing a little alkaline water. Mix well by agitation. Transfer the chloroform to a dry bottle containing the chloride of calcium mixed with* ½ *ounce quicklime. Mix well by agitation. After the lapse of an hour decant the chloroform into a flask, connect the flask with a Liebig's condenser, and distil over the pure chloroform by means of a water-bath; add* 1 *per cent. by weight of ethylic alcohol. Preserve the product in a cool place, in a bottle furnished with an accurately ground stopper.*[1]

The lighter liquid which floats on the crude chloroform after its agitation with water, and the washings with distilled water, should be preserved, and employed in a subsequent operation.

Characters and Tests.—A limpid colourless liquid, of an agreeable ethereal odour, and sweet taste. Dissolves in alcohol and ether in all proportions; and in water 1 in 200, communicating to it a sweetish taste. Burns, though not readily, with a green and smoky flame. Specific gravity, 1·497. Is not coloured by agitation with sulphuric acid; leaves no residue and no unpleasant odour after evaporation.

Dose.—3 to 10 minims.

[1] The changes which take place in the preparation of chloroform are exceedingly complex, and some of the ingredients employed, although essential to the process, seem to perform only secondary duties, and are not seen in the conversion of the alcohol into chloroform. The following explanation, condensed from Attfield's *Chemistry*, represents the most probable nature of the reaction in its main features.

The hypochlorite of calcium, in the chlorinated lime, parts with oxygen and chlorine, to act upon the alcohol, its calcium being liberated as hydrate of calcium, $CaCl_2O_2 + H_2O = CaH_2O_2 + O + Cl_2$. The oxygen acting upon the alcohol probably converts it, in the first instance, into aldehyde (C_2H_4O), thus: $C_2H_6O + O = C_2H_4O + H_2O$. The aldehyde, in the next place, being acted upon by the chlorine, is converted into chloral (C_2HCl_3O), and hydrochloric acid, thus: $C_2H_4O + 6Cl = C_2HCl_3O + 3HCl$. The hydrochloric acid is at once neutralised by some of the liberated hydrate of calcium, so as to form chloride of calcium and water, thus: $CaH_2O_2 + 2HCl = CaCl_2 + 2H_2O$; whilst another portion of the hydrate of calcium reacts upon the chloral so as to form chloroform and formiate of calcium, $Ca(CHO_2)_2$, thus: $2C_2HCl_3O + CaH_2O_2 = Ca(CHO_2)_2 + 2CHCl_3$. Or, neglecting the probable intermediate steps, and regarding simply the materials and the products, four molecules of alcohol and eight of hypochlorite of calcium yield two of chloroform, three of formiate of calcium, five of chloride of calcium, and eight of water, thus: $4C_2H_6O + 8CaCl_2O_2 = 2CHCl_3 + 3Ca(CHO_2)_2 + 5CaCl_2 + 8H_2O$. The subsequent part of the process is intended for the purification of the chloroform.

Chloroform is transparent, heavy, oily, and exceedingly volatile; its odour somewhat resembles that of ripe apples, and it has a sweet but burning taste. It is a powerful solvent, and is itself readily soluble in alcohol and in ether, but only to a slight extent in water.

It sinks in water in globules; its vapour is much heavier than air, and is liable to slowly decompose when exposed to sunlight. The 1 per cent. alcohol is added to preserve it.

Official Preparations.

Name.	Strength.	Dose.
Aqua.	1 in 200.	$\frac{1}{2}$ to 2 fluid ounces.
Linimentum.	1 in 2.	... ...
Spiritus.	1 in 20.	20 to 60 minims.
Tinctura Composita.	1 in 10.	" "
Tinctura et Morphinæ.[1]	1 in 8.	5 to 10 minims.

[1] See Morphinæ Hydrochloras.

AQUA CHLOROFORMI—Chloroform Water.—*Take of chloroform*, 1 *fluid drachm; distilled water*, 25 *fluid ounces. Put them into a 2-pint stoppered bottle, and shake them together until the chloroform is entirely dissolved in the water.*

LINIMENTUM CHLOROFORMI—Liniment of Chloroform.—*Take of chloroform, liniment of camphor, of each* 2 *fluid ounces. Mix.*

SPIRITUS CHLOROFORMI — Spirit of Chloroform — Chloric Ether—Spirit of Chloric Ether.—*Take of chloroform*, 1 *fluid ounce; rectified spirit*, 19 *fluid ounces. Dissolve. Sp. gr.* 0·871.

TINCTURA CHLOROFORMI COMPOSITA — Compound Tincture of Chloroform.—*Take of chloroform*, 2 *fluid ounces; rectified spirit*, 8 *fluid ounces; compound tincture of cardamoms*, 10 *fluid ounces. Mix.*

Therapeutics.—Chloroform, administered in small doses in the fluid form, acts as a carminative, stimulant, and antispasmodic; in larger doses, as a sedative and narcotic, producing symptoms resembling those of alcoholic poisoning. When applied externally undiluted, it acts as a painful counter-irritant, but as an anodyne when diluted. When given in the form of vapour, it acts as an antispasmodic and anæsthetic. It has been recommended internally in cases of neuralgia, in protracted vomiting, in painful and irritable states of the stomach and bowels, in flatulent colic, in lead colic, in spasmodic asthma, in bronchitis and hooping-cough, in hysteria, in delirium tremens, in rheumatism, in tetanus, in dysmenorrhœa, in sea-sickness, &c., &c. As a local application, it is used to allay neuralgia, toothache, rheumatic and other pains, to allay the itching of certain skin diseases, dropped into the ear to relieve otalgia, &c. As an anæsthetic, it is employed in surgical operations, in midwifery, in convulsions, uræmic and otherwise, in strychnine poisoning, &c. There seems no reason to believe that chloroform adds any danger to a surgical operation in a patient affected with heart disease, with the sole exception perhaps of fatty heart. During labour it ought not to be administered continuously or deeply, but simply during the pains, and suspended for the time as each contraction subsides. In dentistry practice, in which chloroform has proved most fatal, the untoward results are probably partly due to the necessity of operating in the semi-erect position. During operations on the mouth or throat it is necessary to see that the throat is kept free of clots. The administration of chloroform is certain to be followed by sickness and vomiting if the patient has partaken of food shortly before commencing its inhalation. But the vomiting is in a measure preventable by forbidding the patient to take food for four hours previously to the operation, and a little brandy may be given before its administration. Chloroform is best administered by means of a handkerchief or towel, which, while it admits free access of air along with the chloroform, permits of being removed the instant it is necessary to suspend the administration; and the patient should be thoroughly under its influence before the surgeon proceeds to operate. Inattention to this rule places the life of the patient in danger, as there is reason to believe that fatal syncope may suddenly occur owing to reflex irritation from pain arresting the heart's action. The administrator can readily judge when the patient is sufficiently under its influence, as there is loss of consciousness and sensibility, with complete muscular relaxation and abolition of reflex movement. The best indications of this condition are that the arm drops without resistance when let fall, the conjunctival reflex is abolished, and no mechanical irritation excites the least consciousness of pain. If the breathing becomes stertorous, the chloroform should be withdrawn; this symptom, which is due to paresis of the muscles of the palate, is one of danger, showing that too much chloroform has been inhaled. When symptoms of failure of the heart's action or respiration manifest themselves, the chloroform should be instantly withdrawn, and the patient exposed to a current of cold air; artificial respiration should be resorted to, the glottis should be kept open by drawing forward the tongue, and tincture of digitalis or solution of atropine or nitroglycerine solution should be injected subcutaneously, or amyl nitrite may be given by inhalation. It cannot be too strongly insisted on that the administrator of chloroform should attend to that and that only, otherwise he cannot pay that attention to the condition of the patient upon which his safety depends.

Impurities.—Chloroform, under the influence of sunlight, is very apt to decompose with formation of hydrochloric acid, phosgene gas (carbonyl chloride, $COCl_2$), and other impurities (CCl_4, &c.). It is then irritating, and has a peculiar, pungent odour. The B.P. tests are directed to detect such impurities. It should be neutral in reaction, showing absence of hydrochloric acid, and should also give no precipitate with nitrate of silver; when heated with potash it should give no coloration indicating absence of aldehyde. The sulphuric acid test (B.P.) indicates absence of organic impurities and hydrocarbons. Carbonyl chloride is tested for by baryta water giving a turbidity, or with zinc iodide and starch, iodine being set free by it, and giving a blue colour.

Æther — Ether—Sulphuric Ether.—A volatile liquid prepared from alcohol, and containing not less than 92 per cent. by volume of pure ether $(C_2H_5)_2O$.

PREPARATION.—*Take of rectified spirit*, 50 *fluid ounces; sulphuric acid*, 10 *fluid ounces; chloride of calcium*, 10 *ounces; slaked lime*, ½ *ounce; distilled water*, 13 *fluid ounces. Mix the sulphuric acid with* 12 *fluid ounces of the spirit in a glass flask capable of containing at least* 2 *pints, and, not allowing the mixture to cool, connect the flask by means of a bent glass tube with a Liebig's condenser, and distil with a heat sufficient to maintain the liquid in brisk ebullition. As soon as the ethereal fluid begins to pass over, supply fresh spirit through a tube into the flask in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. For this purpose use a tube furnished with a stop-cock to regulate the supply, connecting one end of the tube with a vessel containing the spirit raised above the level of the flask, and passing the other end through a cork fitted into the flask. When the whole of the spirit has been added, and* 42 *fluid ounces have distilled over, the process may be stopped. Dissolve the chloride of calcium in the water, add the lime, and agitate the mixture in a bottle with the impure ether. Leave the mixture at rest for ten minutes, pour off the light supernatant fluid, and distil it with a gentle heat until a glass bead, of specific gravity* 0·735, *placed in the receiver, begins to float. The ether and spirit retained by the chloride of calcium and by the residue of each rectification may be recovered by distillation, and used in a subsequent operation.*[1]

Characters and Tests. — A colourless, very volatile, and inflammable liquid, emitting a strong and characteristic odour, and boiling below 105° F. (40°·5 C.). Specific gravity, 0·735. Fifty measures agitated with an equal volume of water are reduced to forty-five by an absorption of 10 per cent. It evaporates without residue.

The vapour of ether is about $2\frac{1}{2}$ times as heavy as air, hence it falls to the ground, and tends to diffuse slowly through the atmosphere; if the vapour come in contact with a light, it very readily catches fire.

Dose.—20 to 60 minims.

Official Preparation.

Spiritus Ætheris, . 1 in 3. *Dose*, 30 to 90 minims.

Also contained in *Collodium* (1 in $1\frac{1}{3}$ nearly), *Collodium Flexile* (1 in $1\frac{1}{3}$ nearly), *Spiritus Ætheris Compositus* (1 in 3 nearly), *Tinctura Chloroformi et Morphinæ* (1 in 32).

SPIRITUS ÆTHERIS — Spirit of Ether.—*Take of ether*, 10 *fluid ounces; rectified spirit*, 1 *pint. Mix. Specific gravity*, 0·809.

Used to make *Tinctura Lobeliæ Ætherea.*

Æther Purus—Pure Ether—Oxide of Ethyl.—Ether $(C_2H_5)_2O$, free from alcohol and water.

Purification.—*Take of ether, distilled water, of each*, 2 *pints; lime, recently burned*, 1 *ounce; chloride of calcium*, 4 *ounces. Put the ether with* 1 *pint of the water into a bottle, and shake them together; allow them to remain at rest for a few minutes, and when the two liquids have separated, decant off the supernatant ether; mix this with the remainder of the water, and again, after separation, decant as before. Put now the washed ether, together with the lime and chloride of calcium, into a retort to which a receiver is closely attached, let them stand for twenty-four hours, then distil with the aid of a gentle heat.*[2]

Tests.—Specific gravity not exceeding 0·720. When shaken with $\frac{1}{4}$ its bulk of solution of iodide of potassium and a little starch paste, no blue colour is produced.[3]

[1] Alcohol has the formula $C_2H_5.HO$; ether $(C_2H_5)_2O$. The object of the process is to abstract one atom of water from two atoms of the former, in order to convert it into the latter. The process, termed etherification, has been explained in several ways, all of

which are much more complex than would at first sight seem necessary for so simple an object. The theory commonly adopted is as follows :—When the alcohol and the sulphuric acid are treated as directed in the first part of the process, a compound is formed, which is called *Sulphovinic Acid* (ethyl hydrogen sulphate) ($C_2H_5HSO_4$), thus : $H_2SO_4 + C_2H_5HO = C_2H_5HSO_4 + H_2O$. In the second stage of the process, the newly-formed sulphovinic acid, and a new atom of alcohol, undergo double decomposition, ether being produced, and the sulphuric acid set at liberty to act upon a fresh atom of alcohol, thus : $C_2H_5HSO_4 + C_2H_5HO = (C_2H_5)_2O + H_2SO_4$. Pure ether distils over only when the temperature of the boiling point is kept within a certain range, a matter which is determined by the relative proportions of alcohol and sulphuric acid in the retort. The temperature to be aimed at is about 285° F., and it is in order to maintain this that the continuous stream of fresh spirit is directed to be added ; for if it were not so, the temperature of the boiling point would gradually rise as the quantity of spirit diminished, until it arrived at 320° F., when empyreumatic products (olefiant gas, heavy oil of wine, &c.) would pass over and contaminate the distillate. On the other hand, if the spirit were added too freely, so as to reduce the temperature of the boiling point below 260° F., alcohol would distil over instead of ether. The sulphuric acid is sufficient for the etherification of all the alcohol, and therefore does not require to be renewed. The subsequent part of the process, with the chloride of calcium and slaked lime, is simply for the purification of the ether, by removing any alcohol, water, sulphuric or sulphurous acids, heavy oil of wine, &c., which may have passed over.

[2] In this process the water washes out the alcohol, and that part of the water which is taken up by the ether is subsequently removed by the lime and chloride of calcium. [3] Absence of an impurity, which is probably aldehyde.

Therapeutics.—Ether is a powerful and rapidly acting diffusible stimulant. It is given as an antispasmodic in nervous cases, and in those in which it is necessary to arouse the vital energies promptly, as in syncope, collapse, or heart failure from any cause. It acts as a very powerful stimulant to the whole circulatory system, for although blood pressure may fall under its use, it does not fall much, while the vessels dilate, and the heart acts more rapidly and vigorously, thus ensuring a much more abundant supply of blood to the brain and other organs. It is usually given hypodermically for such purposes. In the stomach it acts as a carminative and anodyne, and in the intestines it favours the absorption of fats. The most important use of ether is as a general anæsthetic. It is safer than chloroform, as it is not so depressant to the heart, but it is more troublesome to give, and has other drawbacks, such as its extreme inflammability, and its tendency to irritate the bronchial mucous membrane. The relative merits and demerits of ether and chloroform would take up too much space if fully discussed, and the subject is too large to be profitably entered on here. When swallowed in quantity (about 1 to 2 drachms), ether produces much the same effects as alcoholic intoxication, but the exhilaration stage comes on more quickly, and lasts longer, while the stupor is rapidly recovered from. Pure ether when swallowed is very suffocating, from its vapours irritating the upper air passages, and causing spasm of the glottis. When a fine spray is played on the skin for a minute or more, the cold produced by its rapid evaporation causes anæsthesia, and advantage is taken of this in the performance of small surgical operations. The freezing process is not without a certain pain of its own, and this method has been to a large extent superseded by the use of cocaine.

Impurities.—Chiefly *alcohol*, *aldehyde*, and *water*.

Spiritus Ætheris Compositus—Compound Spirit of Ether—Hoffmann's Anodyne.

PREPARATION.—*Gradually mix* 36 *fluid ounces of sulphuric acid with* 40 *fluid ounces of rectified spirit, and let the mixture stand for twenty-four hours.*[1] *Then distil until the fluid in the retort begins to blacken. Shake the distillate with lime water to neutralise any acid, and remove the supernatant liquor and expose it to the air for about twelve hours.*[2] *Pour* 3 *fluid drachms of the resulting liquid into a mixture of* 8 *fluid ounces of ether and* 16 *fluid ounces of rectified spirit.*[3]

Dose.—30 minims to 2 fluid drachms.

[1] The body obtained is called the *heavy oil of wine*, which is a mixture of varying composition, but containing *ethylene sulphate* ($C_2H_4SO_4$), *ethyl sulphate*, *ethylene*, and probably small amounts of numerous other bodies. [2] To evaporate off the ether and other more volatile substances. [3] The preparation is, therefore, a solution of heavy oil of wine in ether and alcohol.

Characters.—It is a colourless, mobile ethereal-looking liquid, with an ethereal odour and taste.

Therapeutics.—It is used as a carminative and stimulant, in flatulence, dyspepsia, colic, and faintness.

Æther Aceticus—Acetic Ether—Acetate of Ethyl, $C_2H_5.C_2H_3O_2$.

PREPARATION.—*Take of rectified spirit, 32¼ fluid ounces; sulphuric acid, 32½ fluid ounces; acetate of sodium, 40 ounces; carbonate of potassium, freshly dried, 6 ounces. To the spirit slowly add the acid, keeping the fluid cool, and, the product being cold, add the acetate, mixing thoroughly. Distil 45 fluid ounces.*[1] *Digest the distillate with carbonate of potassium for three days in a stoppered bottle.*[2] *Separate the ethereal fluid, and again distil*[3] *until all but about 4 fluid ounces have passed over. Preserve the resulting acetic ether in a well-closed bottle and in a cool place.*

Characters and Tests.—A colourless liquid, with an agreeable, ethereal odour. Specific gravity about 0·900. Boiling point about 166° F. (74°·4 C.). Soluble in all proportions in rectified spirit and in ether; one part, by weight, dissolves in about 10 parts of water at 60° F. (15°·5 C.).

Dose.—20 to 60 minims.

Used in making *Liquor Epispasticus.*

[1] The sulphuric acid acting on the alcohol forms ether, and at the same time sets free acetic acid from the acetate of sodium; these combine to form acetic ether. [2] To neutralise any excess of acetic acid. [3] To leave behind inorganic salts and other impurities.

Therapeutics.—Taken by the mouth, it may be used as a stimulant, carminative, and antispasmodic in the same way as ether.

Impurities.—*Alcohol*, *water*, and free *acetic acid*, all of which are readily detected.

Chloral Hydras — Hydrate of Chloral — Hydrous Chloral, $C_2HCl_3O.H_2O$.

Chloral produced by the action of dry chlorine gas on anhydrous alcohol,[1] purified by treatment, first with sulphuric acid[2] and afterwards with a small quantity of lime,[3] and finally converted into hydrous chloral by the addition of water.[4]

Characters and Tests.—In colourless crystals, which do not deliquesce on exposure to air. It has a pungent but not an acrid odour, and a pungent and rather bitter taste. On the application of a gentle heat it fuses to a colourless transparent liquid, which, as it cools, begins to solidify at a temperature of about 120° F. (48°·9 C.). It boils in a test-tube, with pieces of broken glass immersed in it, at from 202° to 206° F. (94°·4 to 96°·7 C.), and at a slightly higher temperature it volatilises on platinum foil without residue. Soluble in less than its own weight of distilled water, rectified spirit, or ether, and in four times its weight of chloroform. The aqueous solution is neutral, or but slightly acid, to test-paper. A solution in chloroform, when mixed by agitation with sulphuric acid, does not impart colour to the acid.[5] One hundred grains of hydrate of chloral, dissolved in 1 ounce of distilled water, and mixed with 30 grains of slaked lime, submitted to careful distillation, with a suitable apparatus, should yield not less than 70 grains of chloroform.[6]

Dose.—5 to 30 grains.

[1] $C_2H_6O + Cl_8 = C_2HCl_3O + 5HCl$. (The name chloral was given to signify its origin from *chlor*ine and *al*cohol.) Anhydrous chloral is a colourless, oily liquid, with a pungent odour, and extremely irritating. By caustic alkalis it is readily decomposed into chloroform and formic acid (see Chloroform). [2] To remove water. [3] To remove excess of acid. [4] It becomes crystalline. [5] Absence of hydrocarbons and other organic impurities. [6] Quantitative test for richness in pure chloral.

Official Preparation.

Syrupus, *Strength* 10 grains in 1 drachm. *Dose*, ½ to 2 fluid drachms.

SYRUPUS CHLORAL—Syrup of Chloral.—*Take of hydrate of chloral,* 80 *grains; distilled water,* 1½ *fluid drachms; simple syrup, a sufficiency. Dissolve the hydrate of chloral in the water, and add the syrup until the mixed product measures a fluid ounce. Specific gravity,* 1·320.

CHLORAL CUM CAMPHORA—Chloral with Camphor (*not official*), B.P.C. — *Take of camphor,* 1 *ounce; hydrate of chloral,* 1 *ounce. Rub together in a warm mortar until completely liquefied, and filter if necessary.*

Therapeutics.—Locally chloral is irritating and strongly antiseptic. When mixed in nearly equal proportions with camphor, phenol, or thymol, it forms a valuable rubefacient and anodyne application in neuralgia, rheumatism, toothache, &c. It is rapidly absorbed from the stomach, and small doses speedily cause sleep lasting several hours without stupor; after large doses there is a good deal of stupor, and the person cannot be readily roused. On awaking, there is usually no general malaise or disturbance of digestion. It is largely employed as a hypnotic in ordinary insomnia, in insanity, in delirium tremens, &c. As a depressant of the spinal cord and antispasmodic, it has been given with success in tetanus, strychnine poisoning, uræmic and other convulsions, hooping-cough, in enuresis, spermatorrhœa, &c. It is also given to relax the os uteri during protracted labour. It is excreted in the urine as uro-chloralic acid (a compound with glycuronic acid), which reduces Fehling's solution, but will not ferment. Chloral very markedly depresses the heart and circulation, the pulse becoming of very low tension. When given as a hypnotic in alcoholic cases it sometimes fails to induce sleep, the patient becoming excited and violent instead of being calmed. It also acts sometimes with unexpected depressing effect on the heart, and comparatively small doses have proved fatal in cases where much larger amounts have been previously given with impunity. It is believed that 30 grains is the smallest dose which has caused death; it is difficult to determine the ordinary fatal dose, but 140 to 150 grains are likely to cause death, though much larger doses, even as high as 460 grains, have been administered without alarming results. But the cases in which it has been so given are mostly those of persons accustomed to the excessive use of alcoholic liquors, and in them there seems to exist a tolerance of the action of chloral, as well as of other narcotics. The symptoms of acute poisoning with it are those of deep coma, great muscular relaxation, apoplectic breathing, flushing of the face, alternating with pallor. Then the breathing becomes less frequent, the jaws fall, the lips become livid, and the extremities cold. Muscular tremors, and even sometimes convulsions, come on. The bronchial surfaces become charged with frothy mucus, which still further impedes the breathing, and death results. The state of the pulse is very variable, but it is usually rapid, weak, and irregular. Treatment should consist in evacuating the contents of the stomach, if the patient is seen in time, in maintaining a warm atmosphere around him, in employing artificial respiration; whilst the strength is supported by easily assimilated nutrients, such as milk and beef-tea, and by the cautious administration of alcoholic stimulants. Strychnine and atropine have both been recommended as physiological antidotes, and the former, at least, should be tried. Long continued in medicinal doses, it is liable to induce a train of very annoying and disagreeable symptoms. These differ with different individuals, but the most marked and frequent are—local redness and congestions; loss of appetite and a tendency to vomit; various skin eruptions, the most common being erythematous and purplish-red small petechial spots—the latter do not disappear on pressure; marked dyspnœa on slight exertion; weak and irregular action of the heart, with a tendency to faint. With these are combined much restlessness and insomnia, except under the influence of the drug, which requires to be given in ever-increasing quantity to secure sleep. There are developed also great apathy and want of both the power and the will to attend to duty. Having regard to these facts, the administration of chloral ought to be recommended with great caution in the case of highly nervous patients, and especially when these have been addicted to over-indulgence in alcoholic drinks. The use of chloral by patients without medical supervision ought to be as far as possible prevented. The disagreeable symptoms disappear entirely on suspending the use of the drug, but treatment in an institution or other extreme measures are often necessary to enable the patient to break off the habit. It is incompatible with alkalis, as chloroform is formed.

Impurities.—Inferior specimens have a very pungent smell from free chlorine, which gives a white precipitate with nitrate of silver; the colour is yellowish, and it leaves oily-looking stains on being pressed between two pieces of blotting-paper; it is only partially soluble in water, forming oily drops. All these point to decomposition having taken place.

Butyl-Chloral Hydras—Hydrate of Butyl-Chloral [1]—Hydrous Butyl-Chloral—Croton-Chloral Hydrate [2]—$C_4H_5Cl_3O.H_2O$.—Butyl-chloral produced by the action of dry chlorine gas on aldehyde cooled to a temperature of 14° F. (−10° C.), separated by fractional distillation, and converted into the solid hydrous butyl-chloral by the addition of water.

Characters and Tests.—In pearly-white crystalline scales, having a pungent but not acid odour, resembling that of hydrous chloral, and an acrid nauseous taste. It fuses at about 172° F. (77°·8 C.) to a transparent liquid, which, in cooling, commences to solidify at about 160° F. (71°·1 C.). Soluble in about 50 parts of water, in its own weight of glycerine, and of rectified spirit, and nearly insoluble in chloroform. The aqueous solution is neutral, or but slightly acid,[3] to litmus paper, and does not yield chloroform when heated with solution of potash or soda or with milk of lime.[4]

Dose.—5 to 15 grains.

[1] It is analogous in constitution to chloral hydrate. Butylic alcohol is $C_4H_{10}O$, the aldehyde of which is C_4H_8O, and in butyl-chloral three chlorine atoms have replaced three of the hydrogen atoms of this body. [2] This name was erroneously given to it at first. [3] No decomposition with formation of hydrochloric acid. [4] Chloral hydrate yields chloroform.

Therapeutics.—Its action resembles that of chloral hydrate, but it is supposed to exert a specific effect in neuralgia of the 5th nerve. It is also used to a limited extent to quiet cough, and as an anti-spasmodic.

Paraldehydum—Paraldehyde, $C_6H_{12}O_3$.—A product of the polymerisation of aldehyde (C_2H_4O) by various acids and salts.

Characters and Tests.—A clear colourless liquid, with a characteristic ethereal odour, and afterwards a cooling taste. Specific gravity, 0·998; boiling point, 255° F. (124° C.). It begins to congeal to a clear crystalline mass at 50° F. (10° C.).[1] One part dissolves in 10 parts water at 60° F. (15°·5 C.), less soluble in hot water; miscible in all proportions with rectified spirit and with ether. The aqueous solution is neutral.[2] It affords no coloration on standing for two hours mixed with a solution of potash or soda,[3] nor any precipitate with a solution of chloride of barium[4] or nitrate of silver.[5]

Dose.—$\frac{1}{2}$ to $1\frac{1}{2}$ fluid drachms.

[1] Only if stirred. [2] Absence of acids used in making it. [3] Aldehyde with potash gives a yellowish colour. [4] Absence of sulphuric acid, and [5] hydrochloric acid.

Therapeutics.—Paraldehyde is a hypnotic, rapidly absorbed and acting rapidly. The sleep is not deep, but lasts several hours. It is excreted by the lungs, and causes a disagreeable odour in the breath; it is often rather irritating to the stomach. In spite of these drawbacks, it is largely used as a means of procuring sleep in general and asylum practice. It may be given in capsule or syrup, or in wine.

Sulphonal—Sulphonal, $C_7H_{16}S_2O_4$.—Diethyl-sulphon-dimethyl-methane,

$$\begin{array}{ccc} CH_3 & & SO_2C_2H_5 \\ & \diagdown \; \diagup & \\ & C & \\ & \diagup \; \diagdown & \\ CH_3 & & SO_2C_2H_5 \end{array}$$

PREPARATION.—*By passing dry hydrochloric acid gas into a mixture of equivalent parts, mercaptan is made to combine with acetone to form mercaptol (dithioethyl-dimethylmethane), which on oxidation with potassium permanganate yields sulphonal.*

$$\underset{\text{Acetone.}}{(CH_3)_2CO} + \underset{\text{Ethylmercaptan.}}{(C_2H_5.SH)_2} = \underset{\text{Dithioethyl-dimethyl-methane.}}{(CH_3)_2C(SC_2H_5)_2}$$

when oxidised

$$= \underset{\text{Sulphonal.}}{(CH_3)_2C(SO_2.C_2H_5} .$$

Characters and Tests.—Colourless, inodorous, nearly tasteless crystals; neutral, melting at 258° F. (125°·5 C.). Soluble in 15 parts boiling water, and in about 450 cold water; in about 50 parts cold rectified spirit, and very soluble in boiling alcohol and ether. Leaves no residue on burning. If a mixture of a few grains with an equal weight of cyanide of potassium be heated, the odour of mercaptan is evolved, and when to the solution of the product in water excess of hydrochloric acid and a few drops of solution of perchloride of iron are added, a reddish colour is evolved.[1]

Dose.—15 to 40 grains.

[1] Sulphocyanide reaction.

Therapeutics.—Sulphonal is a hypnotic, which scarcely depresses the heart and circulation, and which acts through its effects on the nervous system. The sleep lasts from five to eight hours, or thereabouts, and, on awakening, unpleasant after-effects are seldom witnessed. Sometimes, however, the gait is a little affected, there is slight vertigo, and there may be sleepiness. If taken regularly for a long time it may give rise to a cherry-red coloration of the urine (hæmatoporphyrin), to serious structural changes in the kidney, and to muscular weakness and ataxia. The advent of sleep is sometimes delayed, but this may be avoided by giving it in a large quantity of hot water, so that it is thoroughly dissolved and therefore easily absorbed. If it be given undissolved, absorption is very slow, and sleep may come on many hours afterwards at an inconvenient time. It is extremely safe, and very large doses have been given without fatal results.

Amyl Nitris—Nitrite of Amyl.

A liquid produced by the action of nitric or nitrous acid on amylic alcohol, which volatilises between 262° and 270° F. (or about 128° to 132° C.). It consists chiefly of nitrite of amyl, $C_5H_{11}NO_2$. It should be stored in hermetically-sealed vessels or in well-stoppered bottles, and in a cool dark place.

Characters.—An ethereal liquid of a yellowish colour, and peculiar, not disagreeable, odour. Specific gravity, 0·880. Submitted to distillation, about 70 per cent. passes over at 194° to 212° F. (90° to 100° C.), the bulb of the thermometer not dipping below the surface of the residuary fluid. Insoluble in water, soluble in rectified spirit in all proportions. If it be added drop by drop to fused caustic potash, valerianate of potash will be formed.

Dose.—By inhalation, the vapour of 2 to 5 minims; by the mouth from ½ to 1 minim. To be used with caution.

Therapeutics.—When nitrite of amyl is inhaled its action is very rapidly developed. The face, neck, and chest flush. There is beating and lightness in the head, the heart acts more rapidly, and the pulse becomes softer, with a marked and immediate fall of blood-pressure. It greatly dilates the small arterioles by depressing the vasomotor centre, and probably also by a direct action on the walls of the vessels, and thus the flushing and fall of blood-pressure are brought about. There is also sudden flaccidity of voluntary, and especially involuntary, muscles, and hence it has an antispasmodic action. Large doses cause the blood to assume a chocolate hue (methæmoglobin), and also produce glycosuria.

Nitrite of amyl is given in angina pectoris, in spasmodic asthma, and in cardiac failure from chloroform or other causes. It has also been administered with success in spasmodic dysmenorrhœa, in renal and hepatic colic, and in sea-sickness.

Nitroglycerine—Nitroglycerine—(*not official*).—Nitroglycerine is made by the action of strong nitric and sulphuric acids on glycerine, whereby *Tri-nitrate of Glyceryl*, $C_3H_5(NO_3)_3$, is formed. It is a pale yellow oily body, almost insoluble in water, and very explosive on concussion or if heated above 250° C. It burns without explosion if carefully heated in the air. *Dynamite* is infusorial earth (a fine siliceous powder) impregnated with about 75 per cent. of nitroglycerine.

LIQUOR TRINITRINÆ—SOLUTION OF TRINITRIN—LIQUOR NITROGLYCERINI — SOLUTION OF NITROGLYCERINE — LIQUOR GLONOINI—SOLUTION OF GLONOINE.—*Take of pure nitroglycerine,* 1 *part by weight; rectified spirit, sufficient to produce* 100 *fluid parts. Dissolve. Specific gravity,* 0·844.

Dose.—$\frac{1}{2}$ to 2 minims.

TABELLÆ NITROGLYCERINI — TABLETS OF NITROGLYCERINE.—Tablets of chocolate, each weighing $2\frac{1}{2}$ grains, and containing $\frac{1}{100}$ grain of pure nitroglycerine.

Dose.—1 or 2 tablets.

Therapeutics.—When nitroglycerine is absorbed into the blood, it is slowly decomposed by the alkaline fluids of the body, nitrite of glyceryl being formed. Its action in small therapeutical doses is therefore that of a nitrite, as it lowers blood-pressure, dilates the small arteries, quickens the heart, and stimulates the circulation. The action is gentler and more prolonged than that of nitrite of amyl. It is used in angina pectoris, in asthma, and bronchitic asthma, as an antispasmodic, and as a diuretic in Bright's disease, where it lowers arterial tension, and increases the circulation through the kidneys.

Spiritus Ætheris Nitrosi—Spiritus Ætheris Nitrici—Spirit of Nitrous Ether.—A spirituous solution containing nitrous compounds, aldehyde, and other substances.

PREPARATION.—*Take of nitric acid,* 3 *fluid ounces; sulphuric acid,* 2 *fluid ounces; copper, in fine wire (about No.* 25), 2 *ounces; rectified spirit, a sufficiency. To* 1 *pint of the spirit add gradually the sulphuric acid, stirring them together; then add, in the same way,* 2½ *fluid ounces of the nitric acid. Put the mixture into a retort or other suitable apparatus, into which the copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the spirit distil at a temperature commencing at* 170° *F.* (76°·7 *C.*), *and rising to* 175° *F.* (79°·4 *C.*), *but not exceeding* 180° *F.* (82°·2 *C.*), *until* 12 *fluid ounces have passed over and have been collected in a bottle kept cool with ice-cold water; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining* ½ *ounce of nitric acid, and resume the distillation as before, until the distilled product has been increased to* 14 *fluid ounces. Mix this with* 2 *pints of the rectified spirit, or as much as will make the product correspond to the nitric oxide test (see below). Preserve it in well-closed vessels.*

Characters and Tests.—Transparent and nearly colourless, with a very slight tinge of yellow, mobile, inflammable, of a peculiar penetrating apple-like odour, and sweetish cooling sharp taste. When agitated with solution of sulphate of iron and a few drops of sulphuric acid, it becomes deep olive-brown or black.[1] Specific gravity, 0·840 to 0·845. It effervesces feebly, or not at all, when shaken with a little bicarbonate of sodium.[2] Tested as described in the *Pharmaceutical Journal*, 3 ser. vol. xiii. p. 63;[3] or vol. xv. p. 101;[4] or vol. xv. p. 673,[5] it should yield at the ordinary temperature (60° *F.*, 15°·5 *C.*) and pressure (30 inches or 760 millimetres of mercury), and when freshly prepared, seven times its volume of nitric oxide gas; and even after it has been kept some time, and the vessel containing it has been occasionally opened, it should yield not less than five times its volume of the gas.[6]

Dose.—½ to 2 fluid drachms.

[1] Presence of nitrous radical. [2] Absence of much free nitrous or acetic acids. The latter is very apt to form from the aldehyde absorbing oxygen from the air. [3] Eykman's test. [4] Dymond's modification of Eykman's. [5] Allen's test. Eykman's and Dymond's

tests are methods for measuring the volume of nitric oxide (NO) given off when spirit of nitrous ether, ferrous sulphate, and sulphuric acid are heated together, $2FeSo_4+H_2SO_4+2C_2H_5.NO_2=Fe_23SO_4+2C_2H_6O+2NO$. In Allen's method, the nitric oxide is set free by treating the spirit of nitrous ether with an acidulated solution of potassium iodide in the nitrometer. The nitrometer is filled with strong salt solution, 5 c.c. of the spirit of nitrous ether is introduced, then 5 c.c. of the solution of potassium iodide, and lastly, 5 c.c. of dilute sulphuric acid. [6] The yield should be from 25 to 35 c.c. of nitric oxide, which is equal to 2 or 3 per cent. nitrite of ethyl. These tests only take into account the strength in nitrite of ethyl, or nitrous compounds. It disregards the acetic compounds, aldehyde, and all the other numerous constituents. The preparation is a very unstable one. The "Sweet Spirit of Nitre," a preparation very largely used as a domestic remedy, is made by distilling together spirit of wine and nitric acid. It contains very little nitrite, and is also unstable.

Therapeutics.—Spirit of nitrous ether is an alcoholic solution of ethyl nitrite, along with numerous other alcoholic and ethereal substances. It has the same action as nitrite of amyl, but is less active, owing to the ethyl nitrite being so diluted. It is chiefly used as a diaphoretic and diuretic in slight chills and mild feverish attacks, and as an antispasmodic in asthma and bronchitic asthma. It is also useful as a cardiac stimulant.

Sodii Nitris—Nitrite of Sodium, $NaNO_2$.

PREPARATION.—*It is made by fusing sodium nitrate with some reducing substance, such as barium sulphide, dissolving out with water, evaporating, and crystallising. It is sometimes cast into cylindrical sticks.*

Characters and Tests.—A white or yellowish-white deliquescent crystalline salt, very soluble in water. The solution is neutral or slightly alkaline,[1] and when mixed with diluted sulphuric acid yields a gas [2] which forms ruddy fumes [3] in contact with the air. The aqueous solution when mixed with solution of sulphate of iron and acetic acid becomes of a deep brown colour.[4] One grain dissolved in water, introduced into a nitrometer and tested with iodide of potassium and diluted sulphuric acid,[5] should liberate not less than 325 grain measures of nitric oxide, the gas being almost completely absorbed by strong solution of sulphate of iron, corresponding to not less than 95 per cent. of nitrite of sodium. The aqueous solution of the salt must not give more than traces of precipitate with solution of chloride of calcium.[6]

Dose.—2 to 5 grains.

[1] If the reduction of sodium nitrate be greater than suffices to form sodium nitrite, soda is formed which absorbs carbonic acid, and forms the alkaline carbonate. [2] Nitric oxide, NO. [3] Nitric peroxide, NO_2. [4] Nitrate requires sulphuric acid to set free oxygen and produce the brown colour (ferrous oxidised to ferric). [5] See above Spiritus Ætheris Nitrosi. [6] Absence of carbonate of sodium.

Therapeutics.—It has the action of nitrites, but is more persistent and less rapid in action than amyl nitrite or spirit of nitrous ether. It has been used in cardiac angina, asthma, &c. It is readily combined in mixtures, as it is so soluble in aqueous fluids.

Acidum Carbolicum—Carbolic Acid—Phenic Acid—Phenol—Phenic Alcohol, C_6H_5OH.—An acid obtained from coal-tar by fractional distillation[1] and subsequent purification.[2]

Characters and Tests.—In separate pulverulent crystals having a peculiar taste and odour, or in acicular crystalline masses; colourless, or having a very slight reddish or brownish tinge; boiling point not higher than 371° F. (188°·3 C.),[3] and melting point not lower than 91°·5 F. (33° C.).[4] Specific gravity at the melting point 1·060 to 1·066. At 60° F. (15°·5 C.) 100 parts are liquefied by the addition of 5 to 10 parts water; and dissolve 30 to 40 of water, and are dissolved by 1800 to 1200 of water; the former and latter of these numbers being respectively characteristic of the acicular and pulverulent varieties of the acid. The aqueous solution should be clear and colourless, or nearly so, any insoluble brown matter[5] separating as dark oily drops which should not have more than a faint tarry odour. Carbolic acid is freely soluble in alcohol, ether, benzol, chloroform, disulphide of carbon, glycerine, or glycerine and water, and in solutions of alkalies. It does not redden blue litmus paper.[6] It coagulates albumen.[7] It does not affect the plane of polarisation of a ray of polarised light.[8] Neutral solution of perchloride of iron strikes a deep purple colour, and bromine water gives a white precipitate[9] with a cold saturated aqueous solution. Solution of ammonia and of chlorinated soda produce a deep purple coloration, especially after a time.[10]

Dose.—1 to 3 grains.

[1] From the part of the coal-tar which boils between 180° and 190° C. [2] Caustic soda is added to it, and from the sodium carbolate impure carbolic acid is separated by treatment with sulphuric acid.

It is then further purified by fractional distillation and crystallisation. [3] The higher the boiling point the more impure it is. Most pharmacopœias have a lower boiling point (178° to 184° C.) than the B.P. [4] The lower the melting point the more impure it is; 104° F. (40 °C.) is a reasonable limit. [5] Impurities from the coal-tar. [6] If pure it has no acid reaction. [7] Creasote should not do so. [8] Creasote is dextrogyre. [9] Tribromphenol ($C_6H_3Br_3O$). [10] The phenol is oxidised, and yields certain blue colouring matters.

Official Preparations.

Acidum Liquefactum, . .	*Strength* about 90 per cent.
Glycerinum, ...	1 in 6 by weight.
Suppositoria cum Sapone, .	About 1 in 20.
Unguentum, ...	1 in 19.

ACIDUM CARBOLICUM LIQUEFACTUM—LIQUEFIED CARBOLIC ACID.—Carbolic acid liquefied by the addition of 10 per cent. water.

Characters and Tests.—A colourless or very slightly reddish or brownish liquid having the taste, odour, &c., of carbolic acid. Specific gravity 1·064 to 1·067 at 60° F. (15°·5 C.). Boiling point gradually rising to a temperature not higher than 371° F. (188°·3 C.). It dissolves 18 to 26 per cent. of water at 60° F. (15°·5 C.), yielding a clear, or nearly clear, solution, from which any slight coloured impurity contained previously in the acid separates as dark oily drops.

Dose.—1 to 4 minims.

GLYCERINUM ACIDI CARBOLICI—GLYCERINE OF CARBOLIC ACID.

PREPARATION.—*Take of carbolic acid*, 1 *ounce; glycerine*, 4 *fluid ounces. Rub them together in a mortar until the acid is dissolved, or the mixture may be warmed.*

Dose.—5 to 15 minims.

SUPPOSITORIA ACIDI CARBOLICI CUM SAPONE—CARBOLIC ACID SUPPOSITORIES.—*Take of carbolic acid*, 12 *grains; curd soap, in powder*, 180 *grains; glycerine of starch*, 40 *grains, or a sufficiency. Mix the ingredients so as to form a paste of suitable consistence. Divide the mass into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository.*

Each suppository contains 1 *grain of carbolic acid.*

UNGUENTUM ACIDI CARBOLICI—OINTMENT OF CARBOLIC ACID.—*Take of carbolic acid*, 60 *grains; soft paraffin*, 720 *grains;*

hard paraffin, 360 grains. Melt, and stir together constantly until cold.

Carbolic Gauze is unbleached cotton gauze, medicated with about half its weight of a mixture of carbolic acid (1 part), resin (4 parts), and paraffin (4 parts).

Therapeutics.—In strong solution phenol coagulates albumin, and acts as a caustic, forming a white patch, which soon becomes red, and ultimately makes a superficial eschar. It is used for cauterising chronically inflamed and hypertrophied mucous membranes, such as the nasal and uterine. In strong solution (1 in 20) it is very irritating, but, at the same time, causes a feeling of numbness from paralysis of the sensory nerve terminations in the skin ; it is strongly antiseptic and deodorant, and is used for cleansing instruments, &c. Weaker solutions (1 in 50 – 100) are used as lotions.

The glycerine is applied locally in diphtheria, aphthous stomatitis, and similar conditions ; a solution in oil (1 in 20 usually) is used as a dressing for burns, and for lacerated wounds, besides being employed to oil catheters or the fingers. In parasitic skin disease carbolic acid may be used alone or along with other remedies ; it also lessens itching of the skin. The vapour is sometimes inhaled in purulent bronchitis and gangrene of the lungs as a deodorant and antiseptic.

Internally it is sometimes given in fermentative dyspepsia when sarcinæ or yeast are present ; as pills coated with keratin (so as to enable them to pass undissolved through the stomach) it has been given in typhoid fever, and in diarrhœa, to lessen putrefactive changes in the bowel and act as a germicide. In pyæmia and gangrene of the lungs it has also been used.

It is employed as a disinfectant for fæcal discharges, for sputum, &c., and the crude acid for drains and latrines.

It is excreted in the urine as sulpho-carbolate of sodium (potassium), and probably as other bodies closely allied to phenol (hydrochinon). These, on exposure to the air, become oxidised, and give the urine a peculiar dark smoky tint. The sulpho-carbolate is much less poisonous than carbolic acid, and so long as sulphates are present in the bowel or blood (which may be easily ascertained by testing for their presence in the urine) there is no risk of chronic poisoning from carbolic acid. It may be absorbed through the skin and lungs by the patient or surgeon, and then often gives rise to headache, general malaise, pains over the lumbar region, numbness in the extremities, and smoky urine. When a poisonous dose is taken, death may be almost immediate from cardiac failure and collapse, although more often some minutes at least elapse. The chief symptoms are excessive perspiration, stupor, great depression of the circulation, dyspnœa, and diminution of general sensibility and of the reflexes. Death occurs in from one to ten hours usually. The treatment consists in evacuation of the stomach, and the administration of alkalis, especially saccharated solution of lime, and oils. Soluble sulphates should also be given. Sodium sulpho-carbolate is used as a prophylactic in infectious fevers; zinc sulpho-carbolate chiefly as an injection in gonorrhœa.

Creasotum—Creasote.—A product of the distillation of wood-tar.

Characters and Tests.—A liquid, colourless, or with a yellowish tinge,[1] and a strong empyreumatic odour. It is sparingly dissolved by water, but freely by alcohol, ether, and glacial acetic acid. Specific gravity, 1·071. It does not coagulate albumen.[2] A slip of deal dipped into it, and afterwards into hydrochloric acid, acquires, on exposure for a short time to the air, a greenish-blue colour. Dropped on white filtering paper and exposed to a heat of 212° F. (100° C.), it leaves no translucent stain. It turns the plane of polarisation of a ray of polarised light to the right.[3] It is not solidified by the cold produced by a mixture of hydrochloric acid and sulphate of sodium.[4] It is miscible with collodion without production of any precipitate.[5] An aqueous solution (1 per cent.), with a drop of a neutral solution of ferric chloride, yields a green coloration, rapidly changing to a reddish-brown, and unless the mixture is very dilute, giving a reddish-brown precipitate.

Dose.—1 to 3 drops.

[1] It is often brown. [2] Some specimens do coagulate albumen. [3] Squire states that most commercial samples of good creasote have no appreciable effect on polarised light. [4] Phenol is solidified. [5] Creasote with as much as $\frac{1}{3}$ carbolic acid mixes freely with collodion.

These tests are chiefly intended to distinguish between creasote and carbolic acid and other phenols. They are not sufficient, as creasote naturally contains some phenol, and often a considerable quantity. The best test is that creasote is insoluble in glycerine: the glycerine is used diluted with water (1 of water to 3), and 1 volume of creasote is shaken with 3 volumes of this mixture. When it is allowed to separate, the creasote remains undissolved, but the diminution in its volume is a rough test of the amount of impurity which has been dissolved by the glycerine (Allen). Phenol is soluble in glycerine.

The name is derived from κρεας σωτηρ (flesh preserver), as it is the constituent which preserves smoked beef.

Chemistry.—The most important constituents are *Guaiacol*, $C_7H_8O_2$, and *Creosol*, $C_8H_{10}O_2$, *Phenol*, and traces of similar bodies.

Official Preparations.

Name.	Strength.	Dose.
Mistura.	1 in 516.	1 to 2 fluid ounces.
Unguentum.	1 in 9.	... ...
Vapor.	... ...	... ...

MISTURA CREASOTI—CREASOTE MIXTURE.—*Take of creasote, glacial acetic acid, of each,* 15 *minims; spirit of juniper,* ½ *fluid drachm; syrup,* 1 *fluid ounce; distilled water,* 15 *fluid ounces. Mix the creasote with the acetic acid, gradually add the water, and lastly the syrup and spirit of juniper.*

UNGUENTUM CREASOTI—OINTMENT OF CREASOTE.—*Take of creasote,* 1 *fluid drachm; simple ointment,* 1 *ounce. Mix thoroughly.*

VAPOR CREASOTI—INHALATION OF CREASOTE. — *Take of creasote,* 12 *minims; boiling water,* 8 *fluid ounces. Mix the creasote and water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled.*

Therapeutics.—Its action is much the same as that of carbolic acid, but its use is not nearly so extensive. Externally it is employed in parasitic skin diseases, and is inhaled in phthisis, purulent bronchitis, gangrene of the lungs, and other diseases of the respiratory tract. Internally it is given in fermentative dyspepsia, in vomiting, in phthisis, in gangrene of the lung, and in diarrhœa.

Guaiacol (*not official*) is the chief constituent in many samples of creasote, especially that obtained from beechwood, of which it sometimes forms 90 per cent. It is a colourless liquid, with a peculiar odour and hot taste, very slightly soluble in water, soluble in alcohol and fixed oils.

Chemically, it is the methyl ether of *Brenzcatechin*, $C_6H_4<^{OCH_3}_{OH}$.

The *dose* is 1 to 5 minims in capsule, in cod-liver oil, or in alcoholic solution. *Guaiacol Carbonate* and *Salicylate* are crystalline powders, insoluble in water. *Dose.*—5 to 10 grains.

Therapeutics.—Guaiacol is used instead of creasote, and has the advantage of being of constant chemical composition, which creasote is not.

Pix Liquida—Tar—Wood Tar.—A bituminous liquid obtained from the wood of *Pinus sylvestris*, and other species of *Pinus*,[1] by destructive distillation.

Characters.—Thick, viscid, brownish-black, of a well-known peculiar aromatic odour. Water agitated with it acquires a pale-brown colour, sharp empyreumatic taste, and acid reaction.[2]

Tar is chiefly manufactured in Northern Europe, and is known as Stockholm or Archangel tar in commerce, but American tar is also common. When made in iron stills and with modern improvements, the yield is about 14 per cent. from wood, and about 18 from roots. Methyl alcohol, acetic acid, and other bodies are also obtained.

Dose.—5 to 20 grains.

[1] Chiefly *P. Ledebourii*, Endl. (*Larix sibirica*, Ledeb.), and *P. palustris.* [2] The water removes acid and also pyrocatechin, which is present in tar in small colourless crystals, and gives to it the well-known granular appearance. When heated, or if very fluid, the granules disappear.

Pitch (black pitch) is the residuum left by tar on distillation. It is a black, solid body, with a rather unpleasant odour. It has a shining fracture, and is softened by a very gentle heat. It consists of resin and empyreumatic substances found in tar.

Chemistry.—By the destructive distillation of resinous woods, many substances are formed, and tar varies much in composition according to the kind of wood used, the heat applied, method of manufacture, and other details. It contains some *Acetic Acid*, *Acetone*, *Methyl Alcohol*, *Toluol* (C_7H_8), *Xylol* (C_8H_{10}), and several similar bodies, which form the light oil of tar. These, especially the methyl alcohol and acetic acid, are very largely formed during the distillation, but they separate for the most part from the tar proper, and float above it, and only small amounts are found in the tar proper, which is largely made up of empyreumatic *Resins*, *Paraffin*, *Phenol*, *Cresol* ($C_8H_{10}O_2$), *Naphthalin* ($C_{10}H_8$), *Pyrocatechin* ($C_6H_6O_2$), *Pyrene* ($C_{16}H_{10}$), *Chrysene* ($C_{18}H_{12}$), and several more similar hydrocarbons. Pyrocatechin is obtained from the destructive distillation of many bodies, and gives a dark green colour in solution with ferric chloride.

Official Preparation.

Unguentum, . . . *Strength*, 1 in $1\frac{2}{5}$

UNGUENTUM PICIS LIQUIDÆ—Ointment of Tar.—*Take of tar, 5 ounces; yellow wax, 2 ounces. Melt the wax with a gentle heat, add the tar, and stir the mixture briskly while it cools.*

Therapeutics.—Tar is a strong antiseptic, and is also irritant when applied locally. Internally it has been given in winter cough, chronic bronchitis, and in eczema, in capsules and in pills, or with syrups, but is not much used. When taken by the mouth, or absorbed through the skin, some of the products are excreted in the urine and give it a dark colour. It may also cause general malaise, headache, faintness, and vomiting of black fluid with black motions. It is chiefly used externally (as the official or a more diluted ointment) in chronic scaly skin diseases such as eczema, psoriasis, prurigo, &c. On tender skins it gives rise to irritation, and may cause tar acne. In the form of "marine lint" (tow impregnated with fresh tar), it is largely used as a rough surgical dressing.

Oleum Cadinum—Oil of Cade[1]—Huile de Cade—Juniper Tar Oil.—An empyreumatic oily liquid, obtained by the destructive distillation of the woody portions of *Juniperus Oxycedrus*, Linn., and some other species.

Characters.—A dark reddish-brown, or nearly black, more or less viscid oily liquid, with a not unpleasant empyreumatic odour and an aromatic bitter and acrid taste. Specific gravity about 0·990. It is soluble in ether and chloroform ; partially soluble in cold, almost wholly in hot, rectified spirit; very slightly in water. The filtered aqueous solution is almost colourless, and has an acid reaction.

[1] Cade is the French name of the tree.

Chemistry.—It does not differ materially from common tar, but its odour is more agreeable and aromatic, due to some slight differences in their constituents. It contains *Phenol*, *Toluol*, *Cresol*, and other allied bodies of the phenol series.

Therapeutics.—Its action is very similar to that of tar. It is antiseptic and irritant, and is used in the treatment of psoriasis, eczema, and other scaly skin diseases. It may cause a good deal of pain and irritation on tender skins. It is made up into ointment with lard, vaseline, &c. (1 part to 4–10 of ointment base), or may be applied dissolved in weak alcohol.

Acidum Salicylicum—Salicylic Acid, $HC_7H_5O_3$.

A crystalline acid obtained by the combination of the elements of carbolic acid with those of carbonic acid gas, and subsequent purification,[1] or from natural salicylates such as the oils of winter-green[2] (*Gaultheria procumbens*), and sweet birch[2] (*Betula lenta*).

Characters and Tests.—In white acicular crystals,[3] inodorous, but light and easily diffused,[3] and then irritating to the nostrils ; taste at first sweetish, then acid. It is soluble in 500 to 700 parts of water at ordinary temperatures ; readily soluble in alcohol, ether, and hot water ; soluble also in solutions of citrate or acetate of ammonium, phosphate of sodium, or borax. The crystals melt at about 311° F. (155° C.), and below 392° F. (200° C.) volatilise without decomposition.[4] The aqueous solution gives, with solution of perchloride of iron, a reddish-violet colour. An alcoholic solution, allowed to evaporate spontaneously, should leave a perfectly white residue.

Dose.—5 to 30 grains.

[1] Sodium carbolate is formed by mixing soda solution and carbolic acid, and the carbonic acid gas is passed into the mixture yielding salicylicate of sodium, $NaC_6H_5O + CO_2 = NaC_7H_5O_3$, which is decomposed by hydrochloric acid, the resulting salicylic acid being carefully purified. [2] Consists principally of salicylate of methyl. [3] Now often found in large white crystals. [4] There is usually some decomposition.

Official Preparation.

Unguentum, . . . *Strength*, 1 in 28.

UNGUENTUM ACIDI SALICYLICI—Ointment of Salicylic Acid.—*Take of salicylic acid*, 60 *grains; soft paraffin*, 1080 *grains; hard paraffin*, 540 *grains. Melt the hard and soft paraffins together, add the salicylic acid, and stir the whole constantly until cold.*

Sodii Salicylas—Salicylate of Sodium, $(NaC_7H_5O_3)_2H_2O$.

Obtained by the action of salicylic acid on carbonate of sodium or on caustic soda.

Characters and Tests.—Small colourless, or nearly colourless, crystalline scales, inodorous, and having a sweetish saline taste. Slightly but completely soluble in alcohol, readily soluble in water. The solutions are neutral or faintly acid to litmus. When ignited, the salt evolves inflammable vapours, and a white residue remains which effervesces with acids and imparts an intense yellow colour to flame.[1] Perchloride of iron colours a concentrated solution reddish-brown, and a dilute solution violet. If the aqueous solution be acidulated by nitric acid, and the precipitate be dissolved by rectified spirit, the mixture is not rendered more than faintly opalescent by chloride of barium[2] or nitrate of silver.[3] It dissolves without coloration[4] or effervescence[5] in cold sulphuric acid.

Dose.—10 to 30 grains.

[1] Sodium carbonate. [2] Traces of sulphates. [3] Traces of chlorides. [4] Absence of organic impurities. [5] Absence of alkaline carbonate.

Therapeutics.—Salicylic acid is a strong antiseptic and antiputrefactive. As it is so insoluble in water, its solution is aided by borax and other salts, a 1 to 10 per cent. strength being necessary. It is little used as a lotion, but salicylic wool (about 3 to 10 per cent.) is largely employed as an antiseptic dressing. It is very irritating to mucous membranes, and causes sneezing and coughing when drawn into the air-passages. When kept in contact with the skin for some time it gradually destroys the vitality of the horny layers, which peel off after some days. Dissolved in collodion (60 grains to 1 ounce) it is used in this way to get rid of corns and warts, which it does painlessly. In very weak ointment (1 in 100) it is used in acute eczema and other skin diseases, but it is chiefly employed in scaly skin diseases to destroy the thickened and infiltrated cuticle; it is applied made up with collodion or gelatin (60 to 100 grains to 1 ounce) or as salicylic plaster-mulls (up to 50 per cent. of acid). Small quantities are sometimes added to dusting powders as an antiseptic. It is too irritating to give by the stomach, and hence for internal use the salicylate of sodium is preferable. This salt is non-irritating, but has lost to a very large extent the antiseptic action of the free acid. It is rapidly absorbed and excreted in the urine as salicyluric acid, $C_9H_9NO_4$, which gives a purplish colour with perchloride of iron. It is antipyretic and analgesic, and is especially valuable in acute rheumatism, the temperature sometimes falling within a few hours of its administration, and nearly always in two or three days at most; the pain and joint-swelling also subside. There is always a tendency to relapse, and the administration requires to be kept up for some considerable time, but in smaller doses. In chronic rheumatic affections it is not so valuable, but in gout and rheumatic sore-throat it sometimes proves of service. It may cause cardiac depression if given in too large dose. As an antipyretic in typhoid and other fevers it is inferior to other substances, such as quinine and phenacetine. When given in too large doses it may cause deafness, ringing in the ears, disturbance of vision, papular skin eruptions, and a good deal of cardiac and general depression.

Impurities.—Salicylic acid and salicylate of sodium are generally now of sufficient purity. Formerly the "natural" acid and salt made from salicylate of methyl were much purer than the "artificial" substances made from coal tar. These latter contained para-, ortho-, and meta-cresotic (cresotinic) acids in varying amounts; the second of these is very poisonous, the first is probably so, the third has little action, and since attention was drawn to them, special precautions are taken to avoid their presence.

Glusidum — Gluside — Glucusimide — Saccharin — Benzoyl-sulphonic imide, $C_6H_4CO.SO_2NH$.—A sweet imide derivable from the toluene of coal tar.

Characters and Tests.—A light, white, minutely crystalline powder, having an intensely sweet taste in dilute solutions. Heated, it fuses and then sublimes with partial decomposition. It is but slightly soluble in cold water or in chloroform, more so in boiling water, rectified spirit, or glycerine. It is very soluble in diluted solution of ammonia; also in solution of bicarbonate of sodium, with evolution of carbonic acid gas. The latter solution, when warmed and made neutral, and evaporated to dryness, yields "soluble gluside" or "soluble saccharin," which is very soluble in water, 100 parts of gluside yielding nearly 113 of neutral "soluble gluside." Neither gluside nor soluble gluside is blackened by strong sulphuric acid, even when the mixture is gently warmed for a short time. On evaporating either with excess of strong solution of soda, maintaining the residue in a state of semifusion for a few minutes,[1] cooling, dissolving in water, faintly acidulating with hydrochloric acid, and adding a few drops of solution of perchloride of iron, a reddish-brown or purplish colour is produced.[2]

Dose.—½ to 2 grains or more. The "soluble gluside" is generally used in small tablets, containing ½ grain.

[1] Some salicylate of sodium is formed. [2] Salicylic acid reaction.

ELIXIR SACCHARINI—ELIXIR OF SACCHARIN, B.P.C.—(*not official*).—*Take of saccharin,* 480 *grains; bicarbonate of sodium,* 240 *grains; rectified spirit,* 2½ *ounces; distilled water, a sufficiency. Rub the saccharin and bicarbonate of sodium in a mortar, with* ½ *pint of distilled water gradually added. When dissolved, add the spirit, filter, and wash the filter with sufficient distilled water to produce* 1 *pint of elixir. Each fluid drachm contains* 3 *grains of saccharin.*

Dose.—5 to 20 minims.

Therapeutics.—Commercial gluside is supposed to have 300 times the sweetening power of cane sugar; 1 part in 10,000 of water has a sweet taste. It is non-poisonous, is antiseptic, and is excreted unchanged in the urine and saliva, to both of which it imparts a sweet taste. The latter circumstance is a drawback, as the saliva tastes disagreeably sweet for a long time after its ingestion. It is used in diabetes, in corpulence, and other conditions where sugar is an objectionable article of diet, to sweeten food, &c. It is also used in pharmacy to disguise the taste of nauseous medicines.

Acetanilidum — Acetanilide — Antifebrin — Phenyl-acetamide, $C_6H_5.NH.C_2H_3O$.—A crystalline substance obtainable by the action of glacial acetic acid on aniline,[1] and subsequent purification.[2]

Characters and Tests.—Colourless, glistening scaly crystals, having a slightly pungent taste and neutral reaction. Melting point, about 235° F. (112°·8 C.). It is soluble in about 200 parts of cold water; freely soluble in rectified spirit, benzol, and chloroform. Heated with free access of air it burns, leaving no residue.[3] With sulphuric acid it forms a colourless solution. It is soluble in 18 parts boiling distilled water, forming a clear, neutral, inodorous solution, which is not affected by solution of perchloride of iron.[4] Heated with solution of potash and a few drops of chloroform, the unpleasant odour of phenyl-isonitrile is developed.[5]

Dose.—3 to 10 grains in powder, in capsule, &c., or dissolved in alcohol, tincture of orange peel, &c.

[1] By prolonged heating together, aniline, $C_6H_5.NH_2$, has one hydrogen atom replaced by the radical acetyl, C_2H_3O. The name phenyl-acetamide indicates one view of its chemical constitution, viz., that it may be regarded as an amide, or ammonia, in which two hydrogen atoms have been substituted by phenyl and acetyl respectively—

$$N\begin{cases} H \\ C_6H_5 \\ C_2H_3O \end{cases}.$$

[2] By crystallisation. [3] Absence of inorganic matter. [4] Absence of free acetic acid. [5] This is the test for aniline, which is liberated by the caustic potash.

Therapeutics.—Acetanilide is used as an antipyretic and analgesic. It reduces high temperature in pneumonia, typhoid fever, scarlet fever, tuberculosis, and other conditions. The temperature begins to fall shortly after administration, remains low for some hours, and then gradually rises again in from four to ten hours usually. There is often profuse sweating, and when the temperature begins to rise again, there may be rigors or a feeling of chilliness. The perspiration may be prevented by atropine. Its analgesic power is due to a depressing effect on the nervous system, especially on the spinal cord, and hence its value in intercostal and other neuralgias, chronic rheumatic conditions of muscles or tendons, &c.; in migraine dull headache, or the pains of locomotor ataxy, it gives marked relief.

Too large doses alter the hæmoglobin of the blood to methæmoglobin, and depress the heart and respiration, so that intense cyanosis, marked dyspnœa, and collapse may result. These symptoms are induced almost invariably by reckless dosage, or in patients already weakened by disease, and they are rare compared with the large number of cases in which the drug has been given. Faintness, nausea, severe sweating, and skin eruptions are also to be reckoned among its disagreeable effects.

The treatment of poisoning consists in emptying the stomach and bowel, so as to get rid of all the acetanilide, giving ether and other stimulants subcutaneously or by the mouth, and enveloping the body in blankets and applying hot bottles so as to prevent loss of heat.

Impurities.—Free aniline may be detected by dissolving and adding to the solution a few drops of solution of sodium hypobromite, when a reddish-orange precipitate forms. Acetanilide, however, is very stable, and does not readily decompose.

Phenacetinum — Phenacetin — Acetphenetidin — Paracetphenetidin, $C_{10}H_{13}NO_2$.—A crystalline substance produced by the action of glacial acetic acid on paraphenetidin, a body obtained from phenol.[1]

Characters and Tests.—Colourless, tasteless, inodorous, glistening scaly crystals. Melting point, 275° F. (135° C.). Sparingly soluble in cold water, more freely in boiling water, and in about 16 parts rectified spirit. Heated with free access of air, it burns leaving no residue.[2] Sulphuric acid dissolves it without colour. One grain boiled with 20 minims of hydrochloric acid for about half a minute yields a liquid which, diluted with 10 times its volume of water, cooled and filtered, assumes a deep red coloration on the addition of the solution of chromic acid.[3] A cold saturated aqueous solution should not become turbid on the addition of bromine water.[4] A mixture of 5 grains of phenacetin with 2 fluid drachms of solution of potash, boiled, should yield no unpleasant odour when again boiled after the addition of 5 drops of chloroform.[4]

Dose.—5 to 10 grains, in powder usually.

[1] From phenol ($C_6H_5.OH$), amidophenol ($C_6H_4.OH.NH_2$) is formed by a process which need not be here described. Paraphenetidin ($C_6H_4.OC_2H_5.NH_2$) is the ethyl-ether of this body, while para-acet-phenetidin (phenacetin) has the radical acetyl introduced into it ($C_6H_4.OC_2H_5.NH.C_2H_3O$). [2] Absence of inorganic matter. [3] Distinguishes it from acetanilide and phenazone. [4] Absence of acetanilide.

Therapeutics.—It is employed as an antipyretic and analgesic in the same kind of cases as acetanilide. It is much safer than either it or phenazone, and very few cases have been reported in which poisonous or unpleasant effects have occurred after its use. Probably it is the best of these three substances for general use, and it is certainly most efficient as an analgesic.

Phenazonum—Phenazone—Antipyrine—Phenyl-dimethyl-pyrazolone, $C_6H_5(CH_3)_2C_3HN_2O$.—A crystalline substance obtainable from phenyl-hydrazine.[1]

Characters and Tests.—Colourless and inodorous scaly crystals, with a bitter taste, melting at about 230° F. (110° C.); freely soluble in water, rectified spirit, and chloroform, less soluble in ether. It burns, leaving no residue.[2] The watery solution is neutral, and is not affected by sulphuretted hydrogen. One grain of nitrite of sodium and 2 fluid drachms of a 1 per cent. aqueous solution of phenazone yield a nearly colourless[3] liquid, which turns deep green on adding 10 minims of diluted sulphuric acid.[4] An aqueous solution of the same strength, mixed with an equal volume of nitric acid, assumes a yellow colour, passing to crimson on warming. Solution of perchloride of iron produces in very dilute aqueous solution a deep red colour,[5] which is nearly discharged by excess of diluted sulphuric acid.

Dose.—3 to 20 grains, in powder or solution.

[1] Phenyl-hydrazine ($C_6H_5NH.NH_2$) is made from phenol, and by acting on it with aceto-acetic ether ($C_2H_5.C_2H_2O_2.C_2H_3O$) phenyl-methyl-pyrazolone is formed, into which a second methyl group (CH_3) is introduced to form phenyl-dimethyl-pyrazolone or phenazone. [2] Absence of inorganic matter. [3] Allied pyrazolone bodies are acid, and, if present, give the reaction without the addition of any other acid. [4] Free nitrous acid (HNO_2) is formed, which gives rise to the green-coloured isonitroso-phenazone, $C_{11}H_{11}N_3O_2$ (in which NO is substituted for H); spiritus ætheris nitrosi gives the same result as sodium nitrite. [5] Distinguishes it from acetanilide and some of the other antipyretics.

Therapeutics.—Phenazone is chiefly used as an antipyretic and analgesic. Its antipyretic action begins within half an hour after administration, and is very often accompanied by profuse perspiration. The fall lasts from two to sixteen hours, and is probably due chiefly to diminished heat production. It is used in all feverish conditions where it is desired to reduce the temperature, but the danger of collapse in depressed and anæmic persons should not be lost sight of. Small doses stimulate the central nervous system, larger ones are depressant, hence its analgesic action. It is used in all kinds of neuralgia and myalgia, in rheumatic and tabetic pains. It is much less successful in pain from malignant tumours and other serious organic disease. There is no narcosis produced by it. In migraine, headache, dysmenorrhœa, toothache, and other painful conditions, it gives relief, while it is also recommended as an antispasmodic in asthma, whooping-cough, and other spasmodic affections. In diabetes it greatly diminishes the excretion of sugar, and some cases of epilepsy do well under its use. It contracts the arterioles and has been used as a hæmostatic, while in sea-sickness and numerous other conditions it has been administered with more or less benefit. It is rather apt to produce nausea and sickness, while profuse sweating, skin eruptions, vertigo, heaviness, and other not very serious effects occasionally result. Severe collapse with cyanosis and great cardiac weakness have occurred, but usually owing to recklessness in the administration. The treatment of an overdose consists in free stimulation.

Incompatibles.—It is incompatible with spirit of nitrous ether (green crystals form), with tannic acid and preparations containing it, and with salicylate of sodium in powder (oily drops form), but in solution the two are quite compatible.

Paraffinum Durum—Hard Paraffin—Paraffin—Paraffin Wax—Solid Paraffin.—A mixture of several of the harder members of the paraffin series of hydrocarbons; usually obtained by distillation from shale, separation of the liquid oils by refrigeration,[1] and purification of the solid product.

Characters and Tests.—Colourless, semitransparent, crystalline, inodorous, and tasteless; slightly greasy to the touch. Specific gravity, 0·82 to 0·94. Insoluble in water, slightly soluble in absolute alcohol, freely soluble in ether. It melts at 110° to 145° F. (43°·3 to 62°·8 C.), and burns with a bright flame, leaving no residue.

Paraffinum Molle — Soft Paraffin — Petrolatum — Pétroléine—Unguentum Paraffinum.—A semisolid mixture containing some of the softer or more fluid members of the paraffin series of hydrocarbons; usually obtained by purifying the less volatile portions of petroleum. It is known in commerce by various fanciful names.

Characters.—White or yellowish, translucent, soft, greasy; free from acidity, alkalinity, or any unpleasant odour or flavour, even when warmed to 120° F. (48°·9 C.). Specific gravity at the melting point, from about 0·840 to 0·870. Melts at 95° to 105° F. (35° to 40°·5 C.), or even somewhat higher, volatilises without giving acid vapours, and burns with a bright flame, leaving no residue. Insoluble in water, slightly soluble in absolute alcohol, freebly soluble in ether, chloroform, benzol, &c. It is not saponified by solution of alkalies.[2]

[1] The liquid oil consists of a mixture of light hydrocarbons, such as pentane, C_5H_{12}, hexane, C_6H_{14}, &c., and is in the Appendix B.P. under the names petroleum spirit, benzoline, or petroleum ether.
[2] Absence of fat.

Therapeutics.—Soft paraffin alone, or mixed with the hard variety to give it more consistence, is used as an emollient, as a protective, and very largely as a basis for ointments. It is bland and soothing, and does not become rancid like fats, but it is not so readily absorbed by the skin. A mixture of the two is used in the following ointments :—

Unguentum Acidi Borici.	*Unguentum Hydrargyri Oxidi Rubri.*
" " *Carbolici.*	" *Potassæ Sulphuratæ.*
" " *Salicylici.*	" *Sulphuris Iodidi.*
" *Eucalypti.*	" *Veratrinæ.*
" *Glycerini Plumbi Subacetatis.*	

Soft Paraffin is present also in *Unguentum Hydrargyri Nitratis Dilutum* and *Unguentum Zinci Oleati.*

ADDENDUM.

The following preparations were included in the Additions, 1890, to the British Pharmacopœia, 1885. They have either been omitted in the text, or, if mentioned, have been described as non-official. The explanation of this has been already given in the Preface.

TROCHISCI SULPHURIS—Sulphur Lozenges.—*Take of precipitated sulphur*, 3600 *grains ; acid tartrate of potassium*, 720 *grains ; refined sugar, in powder*, 5760 *grains; gum acacia, in powder*, 720 *grains; tincture of orange peel*, 720 *minims; mucilage of acacia*, 720 *minims. Mix the tincture of orange with the powders, and add the mucilage to form a suitable mass. Divide into* 720 *lozenges, and dry these in a hot-air chamber at a moderate temperature. Each lozenge contains* 5 *grains of sulphur.*

Dose.—1 to 6 lozenges.

SODII PHOSPHAS EFFERVESCENS—Effervescent Phosphate of Sodium.—*Take of phosphate of sodium, in crystals*, 25 *ounces ; bicarbonate of sodium, in powder*, 25 *ounces ; tartaric acid, in powder*, $13\frac{1}{2}$ *ounces ; citric acid, in powder*, 9 *ounces. The final product should* *weigh about* 50 *ounces. Dry the phosphate of sodium until it has lost rather more than half* (60 *per cent.*) *of its weight; powder the produce, and mix it with the other ingredients. Place the mixture in a dish or pan of suitable form, heated to between* 200° *and* 220° *F.* (93°·3 *and* 104°·4 *C.*), *and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles.*

Dose.—¼ to ½ ounce.

SODII SULPHAS EFFERVESCENS — EFFERVESCENT SULPHATE OF SODIUM.—*Take of sulphate of sodium, in crystals,* 25 *ounces; bicarbonate of sodium, in powder,* 25 *ounces; tartaric acid, in powder,* 13½ *ounces; citric acid, in powder,* 9 *ounces. The final product should weigh about* 50 *ounces. Dry the sulphate of sodium until it has lost* 56 *per cent. of its weight, then proceed in same way as with the preceding preparation.*

Dose.—¼ to ½ ounce.

MAGNESII SULPHAS EFFERVESCENS — EFFERVESCENT SULPHATE OF MAGNESIUM.—*Take of sulphate of magnesium,* 25 *ounces; bicarbonate of sodium,* 25 *ounces; tartaric acid, in powder,* 9½ *ounces; citric acid, in powder,* 6¼ *ounces; refined sugar, in powder,* 5¼ *ounces. The final product should weigh about* 50 *ounces. Dry the sulphate of magnesium at about* 130° *F.* (54°·4 *C.*) *until it has lost nearly* ¼ *of its weight* (23 *per cent.*); *powder the product, mix it with the sugar, and then proceed as in preceding preparations.*

Dose.—¼ to 1 ounce.

PULVIS SODÆ TARTARATÆ EFFERVESCENS — EFFERVESCENT TARTARATED SODA POWDER—SEIDLITZ POWDER.—*Take of tartarated soda, in dry powder,* 120 *grains; bicarbonate of sodium, in dry powder,* 40 *grains. Mix, and wrap in blue paper. Tartaric acid,* 38 *grains. Wrap in white paper.*

Dose.—The first powder dissolved in nearly half a pint of cold or warm water, and the second powder then added.

Therapeutics. — These four preparations are effervescent saline cathartics.

PILULA FERRI—IRON PILL—BLAUD'S PILL.—*Take of sulphate of iron,* 60 *grains; carbonate of potassium,* 36 *grains; refined sugar, in powder,* 12 *grains; tragacanth, in powder,* 4 *grains; glycerine,* 2½ *minims; distilled water, a sufficiency. Reduce the sulphate of iron to fine powder in a mortar, add the sugar and tragacanth, and mix intimately. Finely powder the carbonate of potassium in another mortar* *and thoroughly incorporate it with the glycerine. Transfer this to the mortar containing the sulphate of iron, beat thoroughly until the mass becomes green, and add water, if necessary, sufficient to impart a pilular consistence. Divide into* 5-*grain pills. Each pill contains about* 1 *grain of carbonate of iron.*

Dose.—1 to 4 pills.

SYRUPUS FERRI SUBCHLORIDI—SYRUP OF SUBCHLORIDE OF IRON—SYRUP OF FERROUS CHLORIDE.—*Take of iron wire,* 300 *grains; hydrochloric acid,* 2 *fluid ounces; citric acid,* 10 *grains; distilled water,* 10 *fluid drachms; syrup, a sufficiency. Mix the hydrochloric acid with* 1 *ounce of the water in a flask, add the iron wire, and apply heat gently until the action ceases. Remove the flask from the heat, add the citric acid, and filter the solution through paper into* 10 *fluid ounces of the syrup, then pass the remainder of the water through the small filter into the syrup. To the product add sufficient syrup to form* 1 *pint of the thoroughly mixed fluid. Its specific gravity should be about* 1·340.

Dose.—½ to 1 fluid drachm.

Hydrastis Rhizoma—Hydrastis Rhizome—Golden Seal.—The dried rhizome and rootlets of *Hydrastis canadensis*, Linn. (see p. 172).

Characters.—The rhizome is simple or branched, from ½ to 1½ inch long and from ⅛ to ½ inch thick, twisted, knotted, and irregular. The upper surface has irregular projections terminated by scars produced by the decay of aërial stems. From the lower surface and sides numerous rootlets are given off. The rhizome is yellowish-brown, becoming darker by age, and has a clean resinous fracture of a brownish-yellow colour, with a bright yellow centre.

Active Principles.—It contains two alkaloids, *Hydrastine* and *Berberine.*

Official Preparations.

Name.	Part Used.	Strength.	Dose.
Extractum Liquidum.	Rhizome.	1 in 1.	5 to 30 minims.
Tinctura.	„	1 in 10.	20 to 60 „

EXTRACTUM HYDRASTIS LIQUIDUM—LIQUID EXTRACT OF HYDRASTIS.—*Take of hydrastis rhizome, in No.* 60 *powder,* 20 *ounces; rectified spirit, distilled water, equal parts, a sufficiency. Moisten the* *powder with about* 8 *fluid ounces of the diluted spirit. Pack the damp powder in a percolator, and pour on sufficient menstruum to saturate it thoroughly. When the liquid begins to drop close the lower orifice of the percolator, and macerate for* 48 *hours; then allow percolation to proceed, gradually adding menstruum until the hydrastis is exhausted. Reserve the first* 17 *fluid ounces of the percolate; evaporate or distil off the spirit from the remainder, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the liquid extract measure* 1 *pint.*

TINCTURA HYDRASTIS—TINCTURE OF HYDRASTIS.—*Take of hydrastis rhizome, in No.* 60 *powder,* 2 *ounces; proof spirit, a sufficiency. Moisten the powder with a suitable quantity of the menstruum, and macerate for* 24 *hours, pack in a percolator, and gradually add proof spirit until* 1 *pint of tincture is obtained.*

Picrotoxinum — Picrotoxin. — A crystalline active principle, obtainable from the seeds of *Anamirta paniculata* by exhaustion with alcohol, evaporation, and purification. (See p. 177.)

Characters and Tests.—It occurs in colourless and odourless prismatic crystals, having a bitter taste. It melts at 378° F. (192°·2 C.); is soluble in 330 parts of cold water, leaving only a trace of residue, in 35 parts of boiling water, in 3 of boiling and 13 of cold rectified spirit. It is soluble in 10 parts of solution of potash, and the resulting liquid, on boiling, immediately reduces Fehling's solution.[1] On burning, it leaves no ash.[2] Its aqueous solution is not precipitated by solutions of perchloride of mercury, perchloride of platinum, or tannic acid.[3] It dissolves in sulphuric acid with a saffron-yellow colour. It is a glucoside, and is said to have the formula $C_{30}H_{34}O_{13}$.

[1] Showing it is a glucoside. [2] Absence of inorganic impurities. [3] Showing it is not an alkaloid.

Dose.—$\frac{1}{100}$ to $\frac{1}{30}$ grain.

Therapeutics.—It has been used with success in the night sweats of phthisis; also in chorea, epilepsy, and chronic alcoholism, but with doubtful benefit. The symptoms of poisoning are the same as those of *Cocculus Indicus* (*q.v.*); there is no known antidote, and cases must be treated on general principles.

LIQUOR COCAINÆ HYDROCHLORATIS — SOLUTION OF HYDROCHLORATE OF COCAINE.—*Take of hydrochlorate of cocaine,* 33 *grains; salicylic acid,* ½ *grain; distilled water, sufficient to produce* 6 *fluid drachms. Boil the water, add the salicylic acid, and then the* *hydrochlorate of cocaine. Cool, and add water, if necessary, to produce the required volume.* (See p. 234.)

Dose.—2 to 10 minims.

LIQUOR MORPHINÆ SULPHATIS—SOLUTION OF SULPHATE OF MORPHINE.—*Take of sulphate of morphine,* 35 *grains; rectified spirit,* 2 *fluid ounces; distilled water, sufficient to produce* 8 *ounces. Dissolve the sulphate of morphine in part of the water, add the rectified spirit, and finally the remainder of the water.*

Dose.—10 to 60 minims.

Euonymi Cortex—Euonymus Bark.—The dried bark of *Euonymus atropurpureus,* Jacquin. (See p. 267.)

Characters.—In quills or curved pieces, varying in thickness from $\frac{1}{12}$ to $\frac{1}{6}$ inch. The outer surface is light ash-grey in colour, with darker patches, dirty white where the epidermis has been rubbed off, soft and friable, with occasional rootlets attached. The inner surface, when free from the white wood, is pale tawny white and smooth. The bark breaks transversely with a finely fibrous fracture, the middle layer having a laminated appearance; longitudinally, the fracture is smooth. Odour faint but characteristic; taste somewhat mucilaginous, and afterwards bitter and slightly acid.

Official Preparation.—Extractum Siccum.

EXTRACTUM EUONYMI SICCUM — DRY EXTRACT OF EUONYMUS—"EUONYMIN."—*Take of euonymus bark, in No.* 20 *powder,* 1 *pound; rectified spirit, distilled water, sugar of milk, a sufficiency. Moisten the euonymus with* 8 *fluid ounces of a mixture of equal parts of rectified spirit and distilled water, and pack in a percolator, then pour on gradually more of the diluted spirit until the euonymus is exhausted. Collect the liquor and evaporate or distil off the spirit. Incorporate so much sugar of milk with the still fluid extract—the actual amount having been ascertained experimentally—that the final product shall contain* 80 *per cent. of the dry extractive. Then evaporate over a water-bath until the mixture, when cold, becomes brittle. The mass may be powdered and kept in a well-corked bottle.*

Dose.—1 to 4 grains.

APPENDIX.

I.

ARTICLES EMPLOYED IN CHEMICAL TESTING (B.P.).

Acetate of Sodium ($NaC_2H_3O_2.3H_2O$).

Benzol.—A colourless volatile liquid, obtained from coal tar, and consisting chiefly of benzol (C_6H_6). Specific gravity, about 0·850.

Benzolated Amylic Alcohol.—Mix together 3 volumes of benzol and 1 of amylic alcohol. Decant the supernatant fluid from any deposited water.

Chloride of Barium ($BaCl_2,2H_2O$).

Copper Foil.—Pure metallic copper, thin and bright.

Ferricyanide of Potassium (Red Prussiate of Potash, $K_6Fe_2C_{12}N_{12}$). *Test.*—Its aqueous solution gives no precipitate with a dilute solution of a pure ferric salt.

Gold, Fine.—Gold, free from metallic impurities.

Hyposulphite of Sodium (Thiosulphate of sodium, $Na_2S_2O_35H_2O$). *Test.*—24·8 grains decolorise 1000 grain-measures of the volumetric solution of iodine.

Indigo (C_8H_5NO).—A blue pigment prepared from various species of *Indigofera*, Linn.

Isinglass.—The swimming-bladder or sound of various species of *Acipenser*, Linn., prepared and cut into fine shreds.

Litmus.—See page 609. A blue pigment prepared from various species of *Roccella*, D.C.

Litmus Paper, Blue.—Unsized white paper steeped in tincture of litmus, and dried by exposure to the air.

Litmus Paper, Red.—Unsized white paper steeped in tincture of litmus which has been previously reddened by the addition of a very minute quantity of sulphuric acid, and dried by exposure to the air.

Oxalate of Ammonium ($(NH_4)_2C_2O_4H_2O$).—Take of oxalic acid, 1 ounce; boiling distilled water, 8 fluid ounces; carbonate of ammonium, a sufficiency. Dissolve the oxalic acid in the water, neutralise the solution with the carbonate of ammonium at finally a boiling temperature, filter it while still hot, and set it by that crystals may form as it cools.

Oxalic Acid of Commerce.—Oxalic acid ($H_2C_2O_4.2H_2O$), not quite pure.

Petroleum Spirit (Benzoline, Petroleum Ether).—A colourless, very volatile, and highly inflammable liquid obtained from petroleum, and consisting of a mixture of the lower members of the paraffin or marsh-gas series of hydrocarbons. Boiling-point, 122° to 140° F. (50° to 60° C.). Specific gravity, about 0·670 to 0·710.

Phenol-Phthalein.—Produced by reaction of phenol and phthalic anhydride. Its tincture yields an intense red colour with potash or soda, hence may be used as an indicator of the termination of volumetric reactions, especially those with organic acids.

Platinum Black.—Platinum in a state of minute division, obtained by adding excess of carbonate of sodium and some sugar to solution of perchloride of platinum, and boiling until a black precipitate is formed, which is washed and dried.

Platinum Foil.

Subacetate of Copper of Commerce.—Verdigris.

Sulphate of Copper, Anhydrous ($CuSO_4$).—Sulphate of copper deprived of its water by a heat of 400° F. (204°·4 C.). *Characters.*—A yellowish-white powder, which becomes blue when moistened with water.

Sulphide of Iron (FeS).—Prepared by combining its elements in proper proportions by the aid of heat. Small quantities may be produced by applying the end of a rod of iron, heated to a white heat at a blacksmith's forge, to the end of a roll of sulphur, and allowing the sulphide of iron as it is formed to run into a vessel of water.

Sulphuretted Hydrogen (H_2S).—Take of sulphide of iron, $\frac{1}{2}$ ounce; water, 4 fluid ounces; sulphuric acid, a sufficiency. Place the sulphate of iron and the water in a gas-bottle, closed with a cork perforated by two holes, through one of which passes air-tight a funnel tube of sufficient length to dip into the water, and through the other a tube for giving exit to the gas. Through the former pour from time to time a little of the acid, so as to develop the sulphuretted hydrogen as it may be required. The gas should always be washed by passing it through a similarly-fitted bottle containing water.

Tin, Granulated.—Grain tin, reduced to small fragments by fusing and pouring into cold water.

Turmeric.—The rhizome of *Curcuma longa*, Linn.

Turmeric Paper.—Unsized white paper steeped in tincture of turmeric and dried by exposure to the air.

Turmeric Tincture.—Take of turmeric, bruised, 1 ounce; rectified spirit, 6 fluid ounces. Macerate for seven days in a closed vessel, and filter.

II.

TEST SOLUTIONS (B.P.).

Solution of Acetate of Copper.—Take of subacetate of copper of commerce, in fine powder, $\frac{1}{2}$ ounce; acetic acid, 1 fluid ounce; distilled water, a sufficiency. Dilute the acid with $\frac{1}{2}$ a fluid ounce of the water; digest the subacetate of copper in the mixture at a temperature not exceeding 212° F. (100° C.), with repeated stirring, and continue the heat until a dry residue is obtained. Digest this in 4 ounces of boiling distilled water, and by the addition of more of the water make up the solution to 5 fluid ounces. Filter it.

Solution of Acetate of Potassium.—Take of acetate of potassium, $\frac{1}{2}$ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Acetate of Sodium.—Take of acetate of sodium, $\frac{1}{2}$ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Albumen.—Take the white of one egg; distilled water, 4 fluid ounces. Mix by trituration in a mortar, and filter through clean tow, first moistened with distilled water. This solution must be recently prepared.

Solution of Ammonio-Nitrate of Silver.—Take of nitrate of silver, in crystals, $\frac{1}{4}$ ounce; solution of ammonia, $\frac{1}{2}$ fluid ounce, or a sufficiency; distilled water, a sufficiency. Dissolve the nitrate of silver in 8 fluid ounces of the water, and to the solution add the ammonia until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water, so that the bulk may be 10 fluid ounces.

Solution of Ammonio-Sulphate of Copper.—Take of sulphate of copper, in crystals, $\frac{1}{2}$ ounce; solution of ammonia, a sufficiency; distilled water, a sufficiency. Dissolve the sulphate of copper in 8 fluid ounces of the water, and to the solution add the ammonia, until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water, so that the bulk may be 10 fluid ounces.

Solution of Ammonio-Sulphate of Magnesium.—Take of sulphate of magnesium, 1 ounce; chloride of ammonium, $\frac{1}{2}$ ounce; solution of ammonia, $\frac{1}{2}$ fluid ounce; distilled water, a sufficiency. Dissolve the sulphate of magnesium and chloride of ammonium in 8 fluid ounces of the water, and to the solution add the ammonia, and as much distilled water as will make up the bulk to 10 fluid ounces. Filter it.

Solution of Boric Acid.—Take of boric acid, 50 grains; rectified spirit, 1 fluid ounce. Dissolve and filter.

Solution of Bromine.—Take of bromine, 10 minims; distilled water, 5 fluid ounces. Place the bromine in a bottle furnished with a well-fitting stopper, pour on the water, and shake several times. Keep it excluded from the light.

Solution of Carbonate of Ammonium.—Take of carbonate of ammonium, in small pieces, $\frac{1}{2}$ ounce; solution of ammonia, $\frac{3}{4}$ fluid ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Chloride of Ammonium.—Take of chloride of ammonium, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Chloride of Barium.—Take of chloride of barium, in crystals, 1 ounce; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Ferricyanide of Potassium.—Take of red prussiate of potash, in crystals, $\frac{1}{4}$ ounce; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Ferrocyanide of Potassium.—Take of yellow prussiate of potash, in crystals, 1 ounce ; distilled water, 5 fluid ounces. Dissolve and filter.

Solution of Iodide of Potassium.—Take of iodide of potassium, 1 ounce ; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Isinglass.—Take of isinglass, in shreds, 50 grains ; warm distilled water, 5 fluid ounces. Mix and digest for half-an-hour on a water-bath, with repeated shaking, and filter through clean tow moistened with distilled water.

Solution of Litmus.—See page 610.

Solution of Oxalate of Ammonium.—Take of oxalate of ammonium, ½ ounce ; warm distilled water, 1 pint. Dissolve and filter.

Solution of Perchloride of Gold.—Take of fine gold, reduced by a rolling machine to a thin lamina, 60 grains ; nitric acid, 1½ fluid drachm ; hydrochloric acid, 7 fluid drachms ; distilled water, a sufficiency. Place the gold in a flask with the nitric acid and 6 fluid drachms of the hydrochloric acid, first mixed with 4 fluid drachms of the water, and digest until it is dissolved. Add to the solution the additional fluid drachm of hydrochloric acid, evaporate at a heat not exceeding 212° F. (100° C.) until acid vapours cease to be given off, and dissolve the chloride of gold thus obtained in 5 fluid ounces of distilled water. The solution should be kept in a stoppered bottle.

Solution of Perchloride of Platinum.—Take of thin platinum foil, ¼ ounce ; nitric acid, a sufficiency ; hydrochloric acid, a sufficiency ; distilled water, 7 fluid ounces. Mix a fluid ounce of the nitric acid with 4 fluid ounces of the hydrochloric acid and 2 fluid ounces of the water ; pour the mixture into a small flask containing the platinum, and digest at a gentle heat, adding more of the acids, mixed in the same proportion, should this be necessary, until the metal is dissolved. Transfer the solution to a porcelain dish, add to it a fluid drachm of hydrochloric acid, and evaporate on a water-bath until acid vapours cease to be given off. Let the residue be dissolved in the remaining 5 ounces of distilled water. Filter and preserve it in a stoppered bottle.

Solution of Phosphate of Sodium.—Take of phosphate of sodium, in crystals, 1 ounce ; distilled water, 10 fluid ounces. Dissolve and filter.

Solution of Potassio-Cupric Tartrate (Fehling's Solution).—1. Take of sulphate of copper, 346·4 grains ; distilled water, a sufficiency. Dissolve the sulphate of copper in a portion of the water, and dilute the solution with more water up to 5000 grain measures. 2. Take of caustic soda, 1¾ ounce; tartarated soda, 4 ounces; distilled water, a sufficiency. Dissolve the caustic soda and the tartarated soda in a portion of the water, and then add water to 5000 grain measures. When required for use, mix equal volumes of the solutions 1 and 2.

Solution of Potassio-Mercuric Iodide (Nessler's Reagent).—Take of iodide of potassium, 135 grains; perchloride of mercury, a sufficiency; caustic soda, 2 ounces; distilled water, 1 pint. Dissolve the iodide of potassium and 100 grains of the perchloride of mercury in 15 fluid ounces of boiling distilled water. To this fluid add more aqueous solution of the perchloride of mercury until the precipitate produced no longer continues to disappear on well stirring, and a slight permanent precipitate remains. Then add the caustic soda. When the latter has dissolved, add a little more of the aqueous solution of perchloride of mercury, shake, allow to settle, and dilute the whole with distilled water to the volume of 1 pint. The solution should be kept in a stoppered bottle.

Solution of Stannous Chloride.—Take of granulated tin, 1 ounce; hydrochloric acid, 3 fluid ounces; distilled water, a sufficiency. Dilute the acid in a flask with 1 fluid ounce of the water, and, having added the tin, apply a moderate heat until gas ceases to be evolved. Add as much of the water as will make up the bulk to 5 fluid ounces, and transfer the solution, together with the undissolved tin, to a bottle with an accurately ground stopper.

Solution of Sulphate of Indigo.—Take of indigo, dry, and in fine powder, 5 grains; sulphuric acid, 10 fluid ounces. Mix the indigo with a fluid drachm of the sulphuric acid in a small test-tube, and apply the heat of a water-bath for an hour. Pour the blue liquid into the remainder of the acid, agitate the mixture, and, when the undissolved indigo has subsided, decant the clear liquid into a stoppered bottle.

Solution of Sulphate of Iron.—Take of granulated sulphate of iron, 10 grains; boiling distilled water, 1 fluid ounce. Dissolve and filter. This solution should be recently prepared.

Solution of Sulphate of Calcium.—Take of sulphate of calcium, ¼ ounce; distilled water, 1 pint. Rub the sulphate of calcium in a porcelain mortar for a few minutes with 2 ounces of the water, introduce the mixture thus obtained into a pint bottle containing the rest of the water, shake well several times, and allow the undissolved sulphate to subside. When this has occurred, filter.

Solution of Sulphydrate of Ammonium.—Take of solution of ammonia, 5 fluid ounces. Put 3 fluid ounces of the ammonia into a bottle, and conduct into this a stream of sulphuretted hydrogen so long as the gas continues to be absorbed ; then add the remainder of the ammonia, and transfer the solution to a green glass bottle furnished with a well-ground stopper.

Solution of Tartaric Acid.—Take of tartaric acid, in crystals, 1 ounce ; distilled water, 8 fluid ounces ; rectified spirit, 2 fluid ounces. Dissolve the tartaric acid in the water, add the rectified spirit, and preserve the solution in a stoppered bottle.

Solution of Yellow Chromate of Potassium.—Take of red chromate of potassium, 295 grains ; bicarbonate of potassium, 200 grains ; distilled water, 10 fluid ounces. Dissolve the red chromate in the water, and exactly neutralise the solution with the bicarbonate, evolution of all carbonic acid being ensured by ebullition. Filter.

Tincture of Phenol-Phthalein.—Take of phenol-phthalein, 1 grain ; proof spirit, 500 grains. Dissolve. The solution should be colourless.

III.

TEST SOLUTIONS FOR VOLUMETRIC ESTIMATIONS (B.P.).

The processes for volumetric estimations may be performed either with British or with metric weights and measures, and the solutions are so arranged that they will be of the same strength, and the same indications will be obtained in using them, whichever system is employed, without the necessity of altering any of the figures by which the quantities of the substances tested, or of the test solutions required in the process, are expressed.

According to the British system, the quantities of the substances to be tested are expressed in grains by weight, whilst the quantities of the test solutions employed in testing are expressed in grain measures—the grain measure being the volume of a grain of distilled water.

According to the metric system, the quantities of the substances to be tested are expressed in grammes by weight, whilst the quantities of the test solutions employed in testing are expressed in cubic centimetres—the cubic centimetre being the volume of a gramme of distilled water.

As the cubic centimetre bears the same relation to the gramme that the grain measure bears to the grain, the one system may be substituted for the other with no difference in the results, excepting that, by the metric system, all the quantities will be expressed in relation to a weight (the gramme) which is more than fifteen times (15·432) as great as the British grain.

In practice it will be found convenient, in substituting metric for British weights and measures, to reduce the values of all the numbers to one-tenth, by moving the decimal points, and this has been done in the tables appended to the descriptions of the volumetric solutions. The quantities indicated in the Pharmacopœia, which in grains and grain measures can be conveniently used, would be found inconveniently large if the same number of grammes and cubic centimetres were employed.

The following apparatus is required in the preparation and use of these solutions:—

For British weights and measures—

1. A flask which, when filled to a mark on the neck, contains exactly 10,000 grains of distilled water at 60° F. (15°·5 C.). The capacity of the flask is, therefore, 10,000 grain measures.

2. A graduated cylindrical jar which, when filled to 0, holds 10,000 grains of distilled water, and is divided into 100 equal parts.

3. A burette. A graduated glass tube which, when filled to 0, holds 1000 grains of distilled water, and is divided into 100 equal parts. Each part, therefore, corresponds to 10 grain measures.

For metric weights and measures—

1. A glass flask which, when filled to a mark on the neck, contains 1 litre, or 1000 cubic centimetres.

2. A graduated cylindrical jar, which, when filled to 0, contains 1 litre (1000 cubic centimetres), and is divided into 100 equal parts.

3. A burette. A graduated tube which, when filled to 0, holds 100 cubic centimetres, and is divided into 100 equal parts.

(1 cubic centimetre is the volume of 1 gramme of distilled water at 4° C.[1] (39°·2 F.). 1000 cubic centimetres equal 1 litre.)

[1] It is customary to make the measurements with metric apparatus at 60° Fahr. (15°·5 C.).

Volumetric solutions, before being used, should be shaken, in order that they may be throughout of uniform strength. They should also be preserved in stoppered bottles. All measurements should be made at 60° F. (15°·5 C.).

Volumetric Solution of Bichromate of Potassium (Bichromate of Potassium, $K_2Cr_2O_7 = 295$).—Take of bichromate of potassium, 147·5 grains; distilled water, a sufficiency. Put the bichromate of potassium into the 10,000 grain flask, and, having half-filled the flask with water, allow the salt to dissolve; then dilute the solution with more water, until it has the exact bulk of 10,000 grain measures. 1000 grain measures of this solution contain 14·75 grains of the bichromate ($\frac{1}{20}$th of $K_2Cr_2O_7$, in grains), and when added to a solution of ferrous salt, acidulated with hydrochloric acid, are capable of converting 16·8 grains of iron ($\frac{1}{20}$th of 6Fe, in grains) from the ferrous to the ferric state.

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. Thus, 14·75 grammes of bichromate of potash should be made to form 1000 cubic centimetres of solution. 100 cubic centimetres of this solution contain 1·475 grammes of the bichromate ($\frac{1}{200}$th of $K_2Cr_2O_7$, in grammes), and, when added to a solution of a ferrous salt acidulated with hydrochloric acid, are capable of converting 1·68 grammes of iron ($\frac{1}{200}$th of 6Fe, in grammes) from the ferrous to the ferric state.

This solution is used for determining the proportion of ferrous salt in the following preparations. It is known that the whole of ferrous has been converted into a ferric salt when a minute drop of the liquid, placed in contact with a drop of a very dilute solution of ferricyanide potassium on a white plate, ceases to strike with it a blue colour.

	British weights and measures.				Metric weights and measures.		
	Grains weight of Substance.	=	Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Ferri Arsenias	100·0	=	225	or	10·0	=	22·5
,, Carb. Sach.	30	=	287·5	or	3·0	=	28·75
,, Phosphas	30	=	279	or	3·0	=	27·9
,, Sulphas	42·1	=	500	or	4·21	=	50·0
,, ,, Exsiccata	10·0	=	191	or	1·0	=	19·1
,, ,, Granulata	41·7	=	500	or	4·17	=	50·0

Volumetric Solution of Hyposulphite of Sodium (Hyposulphite of Sodium crystallised, $Na_2S_2O_35H_2O=248$).—Take of hyposulphite of sodium, in crystals, 280 grains ; distilled water, a sufficiency.

Dissolve the hyposulphite of sodium in 10,000 grain measures of water. Fill a burette with this solution, and drop it cautiously into 1000 grain measures of the volumetric solution of iodine, until the brown colour is just discharged. Note the number of grain measures (n) required to produce this effect ; then put 8000 grain measures of the same solution into a graduated jar, and augment this quantity by the addition of distilled water until it amounts to $\frac{8000\times1000}{n}$ grain measures. If, for example, $n=950$, the 8000 grain measures of solution should be diluted to the bulk of $\frac{8000\times1000}{950}=8421$ grain measures. 1000 grain measures of this solution contain 24·8 grains of the hyposulphite ($\frac{1}{10}$th of $Na_2S_2O_35H_2O$, in grains), and therefore correspond 12·7 grains of iodine ($\frac{1}{10}$th of an atomic weight in grains).

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres of this solution contain 2·48 grammes of the hyposulphite ($\frac{1}{100}$th of $Na_2S_2O_35H_2O$, in grammes), and therefore correspond to 1·27 grains of iodine ($\frac{1}{100}$th of an atomic weight in grammes).

This solution is used for testing the following substances. In each case, excepting that of iodum, a solution of iodide of potassium and hydrochloric acid are added to the substance, and the amount of iodine so liberated is indicated by this solution.

	British weights and measures.				Metric weights and measures.		
	Grains weight of Substance.	=	Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Calx Chlorinata . .	5·0	=	467	or	0·5	=	46·7
Iodum	12·7	=	1000	or	1·27	=	100·0
Liq. Calc. Chlorinatæ .	80·0	=	450	or	8·00	=	45·0
,, Chlori . . .	439·0	=	750	or	43·90	=	75·0
,, Sodæ Chlorinatæ .	70·0	=	500	or	7·00	=	50·0

Volumetric Solution of Iodine (Iodine, $I=127$).—Take of iodine, 127 grains ; iodide of potassium, 180 grains ; distilled water, a sufficiency. Put the iodide of potassium and the iodine into the 10,000 grain flask, fill the flask to about two-thirds its bulk with distilled water, gently agitate until solution is complete, and then dilute the solution with more water until it has the exact volume of 10,000 grain measures. 1000 grain measures of this solution contain $\frac{1}{10}$th of an atomic weight in grains (12·7 grains) of iodine, and therefore correspond to 1·7 grains of sulphuretted hydrogen, 3·2 grains of sulphurous anhydride, and 4·95 grains of arsenious anhydride.

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain 1·27 grammes of iodine, and correspond to 0·17 grammes of sulphuretted hydrogen, 0·32 grammes of sulphurous anhydride, and 0·495 grammes of arsenious anhydride.

This solution is used for testing the following substances. It is dropped from the burette into the liquid to be tested until free iodine begins to appear in the solution.

	British weights and measures.				Metric weights and measures.		
	Grains weight of Substance.	=	Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acid. Arseniosum . .	4·0	=	808	or	0·40	=	80·80
,, Sulphurosum .	64·0	=	1000	or	6·40	=	100·0
Liquor Arsenicalis . .	442·0	=	875	or	44·20	=	87·50
,, Arsenici Hydrochloricus .	442·0	=	875	or	44·20	=	87·50
Sodii Hyposulphis . .	24·8	=	100	or	2·48	=	100

Volumetric Solution of Nitrate of Silver (Nitrate of Silver, $AgNO_3=170$).—Take of nitrate of silver, 170 grains ; distilled water, a sufficiency. Put the nitrate of silver into the 10,000 grain flask, and, having half-filled the flask with water, allow the salt to dissolve ; then dilute the solution with more water until it has the exact bulk of 10,000 grain measures. The solution should be kept in an opaque stoppered bottle. 1000 grain measures of this solution contain $\frac{1}{10}$th of a molecular weight in grains of nitrate of silver (or 17·0 grains).

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{100}$th of an equivalent in grammes of nitrate of silver (or 1·7 grammes).

It is used in testing the following substances :—

	British weights and measures.				Metric weights and measures.		
	Grains weight of Substance.	=	Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acid. Hydrocyan. Dil. .	270	=	1000	or	27·0	=	100·0
Ammon. Bromid. . .	5	=	508·5 to 514·5	or	0·5	=	50·85 51·45
Potass. Bromid. . .	10	=	838 to 850	or	1·0	=	83·8 to 85·0
,, Cyanid. . .	10	=	730	or	1·0	=	73·0
,, Iodid. . . .	10	=	602	or	1·0	=	60·2
Sodii Bromid. . . .	10	=	960	or	1·0	=	96·0
,, Iodid. . . .	10	=	660	or	1·0	=	66·0

Volumetric Solution of Oxalic Acid (Crystallised Oxalic Acid, $H_2C_2O_4 2H_2O = 126$).—Take of oxalic acid, in crystals, 660 grains; distilled water, a sufficiency. Put the oxalic acid into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with water, allow the acid to dissolve, and then dilute the solution with more water, until it has the exact volume of 10,000 grain measures. Fill a burette with the fluid, and add it gradually to a solution of 10·6 grains of pure carbonate of sodium (which may be obtained by heating the ordinary pure bicarbonate of sodium to redness in a platinum crucible for a quarter of an hour), containing a few drops of solution of litmus, until the red colour produced ceases to change to blue on boiling. Note the number of grain measures used (n), then put 9000 grain measures of the solution of oxalic acid into a graduated jar, and augment this quantity by the addition of distilled water until it amounts to $\frac{9000 \times 200}{n}$ grain measures. 1000 grain measures of this solution contain half a molecular weight in grains (63 grains) of oxalic acid, and are therefore capable of neutralising one equivalent in grains of such alkalis as potash, KHO, or soda, NaHO, or half the molecular weight in grains of such salts as anhydrous carbonate of sodium, Na_2CO_3, crystalline carbonate of sodium, Na_2CO_3, $10H_2O$, &c.

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{20}$th of a molecular weight in grammes (6·3 grammes) of oxalic acid, and will neutralise $\frac{1}{10}$th of a molecular weight in grammes of an alkali.

The following substances are tested with this solution :—

	British weights and measures.			Metric weights and measures.		
	Grains weight of Substance.	= Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Ammonii Carb. . .	52·3	= 1000	or	5·23	=	100·0
Borax . . .	191·0	= 1000	or	19·10	=	100·0
Liq. Ammon. . .	85·0	= 500	or	8·50	=	50·0
,, ,, Fort .	52·3	= 1000	or	5·23	=	100·0
,, Calcis .	4375·0	= 180	or	437·5	=	18
,, ,, Sacchar. .	460·2	= 254	or	46·02	=	25·4
,, Plumbi Subacet.	284·5	= 500	or	28·45	=	50
,, Potassæ . .	462·9	= 482	or	46·29	=	48·2
,, ,, Efferves.	4375·0	= 150	or	437·50	=	15·0
,, Sodæ . .	458·0	= 470	or	45·80	=	47·0
,, ,, Efferves.	4375·0	= 178	or	437·50	=	17·8
Plumbi Acetas . .	38·0	= 200	or	3·80	=	20·0
Potassa Caustica .	56·0	= 900	or	5·60	=	90·0
Potassii Bicarb. .	50·0	= 500	or	5·00	=	50·0
,, Carb. . .	83·0	= 980	or	8·30	=	98·0
,, Citras . .	102·0	= 1000	or	10·20	=	100·0
,, Tartras .	122·0	= 990	or	12·2	=	99
,, ,, Acida	204·0	= 1000	or	20·40	=	100·0
Soda Caustica . .	40·0	= 900	or	4·00	=	90·0
,, Tartarata . .	141·0	= 990	or	14·1	=	99
Sodii Bicarb. . .	84·0	= 1000	or	8·40	=	100·0
,, Carb. . .	143·0	= 960	or	14·30	=	96·0
Sodium . . .	23·0	= 975	or	2·30	=	97·5

Volumetric Solution of Soda (Hydrate of Sodium, $NaHO = 40$).—Take of solution of soda, a sufficiency; distilled water, a sufficiency. Fill a burette with the solution of soda, and cautiously drop this into 1000 grain measures of the volumetric solution of oxalic acid, until the acid is exactly neutralised as indicated by litmus. Note the number of grain measures (n) of the solution used, and having then introduced 9000 grain measures of the solution of soda into a graduated jar, augment this quantity by the addition of water until it becomes $\frac{9000 \times 1000}{n}$ grain measures. If, for example, $n = 930$, the 9000 grain measures should be augmented to $\frac{9000 \times 1000}{930} = 9677$ grain measures. 1000 grain measures of this solution contain one molecular weight in grains (40 grains) of hydrate of sodium, and will therefore neutralise one molecular weight in grains of any monobasic acid, or half the molecular weight in grains of any dibasic acid, &c.

Grammes and cubic centimetres may be employed instead of grains and grain measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimetres contain $\frac{1}{10}$th of a molecular weight in grammes (4 grammes) of hydrate of soda, and will neutralise $\frac{1}{10}$th of an equivalent in grammes of a monobasic acid.

This solution is used for testing the following substances :—

	British weights and measures.				Metric weights and measures.		
	Grains weight of Substance.	=	Grain measures of Vol. Sol.	or	Grams. wt. of Substance.	=	C. C. of Vol. Sol.
Acetum	445·4	=	402	or	44·54	=	40·2
Acid. Acet. . . .	182·0	=	1000	or	18·20	=	100·0
,, ,, Dil. . .	440·0	=	313	or	44·00	=	31·3
,, ,, Glac. . .	60·0	=	990	or	6·00	=	99·0
,, Citric . . .	70·0	=	1000	or	7·00	=	100·0
,, Hydrobrom. Dil. .	810·0	=	1000	or	81·00	=	100
,, Hydrochl. . .	114·8	=	1000	or	11·48	=	100·0
,, ,, Dil. .	345·0	=	1000	or	34·50	=	100·0
,, Lactic . . .	120·0	=	1000	or	12·00	=	100·0
,, ,, Dil. . .	800·0	=	1000	or	80·00	=	100·0
,, Nitric . . .	90·0	=	1000	or	9·00	=	100·0
,, ,, Dil. . .	361·3	=	1000	or	36·13	=	100·0
,, Nitro-hydroc. Dil.	352·0	=	883	or	35·20	=	88·3
,, Sulphuric . .	50·0	=	1000	or	5·00	=	100·0
,, ,, Arom. .	195·0	=	500	or	19·50	=	50
,, ,, Dil. .	359·0	=	1000	or	35·90	=	100·0
,, Tartaric . .	25·0	=	330	or	2·5	=	33·0

Indicators of the Termination of Reactions in Volumetric Operations.

Mucilage of Starch.—It gives an intense blue colour with iodine. It may be used with the following substances :—

Acidum Arseniosum.
,, Sulphurosum.
Calx Chlorinata.
Iodum.
Liquor Arsenicalis.
Liquor Arsenici Hydrochloricus.
,, Calcis Chlorinatæ.
,, Sodæ Chlorinatæ.
,, Chlori.
Sodii Hyposulphis.

Solution of Ferricyanide of Potassium.—It gives an intensely blue precipitate with ferrous salts, but none with ferric salts. It is used with the following substances :—

Ferri Arsenias.
,, Carbonas Saccharata.
,, Phosphas.

Ferri Sulphas.
,, ,, Exsiccata.
,, ,, Granulata.

Solution of Litmus.—It gives a red colour with acids and a blue colour with alkalis. It may be used with the following substances :—

Acidum Hydrochloric.
,, ,, Dil.
,, Nitricum.
,, ,, Dil.
,, Nitro-hydrochl. Dil.
,, Sulphuricum.
,, ,, Arom.
,, ,, Dil.
Ammon. Carb.
Borax.
Liq. Ammon.
,, ,, Fort.
,, Calcis.
,, ,, Sacchar.

Liquor Potassæ.
,, ,, Effervesc.
,, Sodæ.
,, ,, Effervesc.
Potassa Caustica.
Potass. Bicarb.
,, Carb.
,, Citras.
,, Tartras.
,, ,, Acid.
Soda Caustica.
,, Tartarata.
Sodii Bicarb.
,, Carb.

Solution of Yellow Chromate of Potassium.—It gives a red colour with nitrate of silver, but not until any soluble bromide or iodide present is entirely decomposed. It may be used with the following substances :—

Ammonii Bromidum.
Potassii ,,
,, Iodidum.

Sodii Bromidum.
,, Iodidum.

Tincture of Phenol-Phthalein.—It gives an intense red colour with potash or soda. It may be used with the following substances :—

Acetum.
Acid. Acetic.
,, ,, Dil.

Acid. Acetic Glaciale.
,, Citric.
,, Tartaric.

SYMBOLS AND EQUIVALENT WEIGHTS OF THE ELEMENTARY BODIES MENTIONED IN THE BRITISH PHARMACOPŒIA.

Elementary Bodies.	Symbols and Atomic Weights.
Aluminium	Al = 27
Antimony (Stibium) . . .	Sb = 120
Arsenic	As = 75
Barium	Ba = 137
Bismuth	Bi = 209
Boron	B = 11
Bromine	Br = 80
Calcium	Ca = 40
Carbon	C = 12
Cerium	Ce = 141
Chlorine	Cl = 35·5
Chromium	Cr = 52·5
Copper (Cuprum) . . .	Cu = 63·4
Gold (Aurum) . . .	Au = 196·5
Hydrogen	H = 1
Iodine	I = 127
Iron (Ferrum) . . .	Fe = 56
Lead (Plumbum) . . .	Pb = 207
Lithium	L = 7
Magnesium	Mg = 24
Manganese	Mn = 55
Mercury (Hydrargyrum) . .	Hg = 200
Nitrogen	N = 14
Oxygen	O = 16
Phosphorus	P = 31
Platinum	Pt = 195
Potassium (Kalium) . . .	K = 39
Silver (Argentum) . . .	Ag = 108
Sodium (Natrium) . . .	Na = 23
Sulphur	S = 32
Tin (Stannum) . . .	Sn = 118
Zinc	Zn = 65

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