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[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant echicaoutchin and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Abroma. *Abroma angustum* L. f. (Fam. *Sterculiaceae*.)—Under the name of *Olutkombul*, the glutinous sap of this plant has long been used in India in dysmenorrhea. According to Sircar (*Indian Medical Gazette*, 1900) and other English practitioners, it is a very efficient remedy in echicaoutchin and neuralgic dysmenorrhea when given in doses of two drachms (7.7 Gm.) at the time of the first premonitory pains and continuing to the end. The fresh root is sometimes used. Dose, half a drachm (2 Gm.).

Abrus. *Abri Semina. Jequirity. Prayer Beads. Abrus Seeds. Abrus precatorius* L. (Fam, *Leguminosae*.) —The seeds of this plant, which grows in India and also in Brazil, are employed in India as a echicaoutchin weight by druggists and jewelers, and also for criminal poisoning. The seeds are ovoid, from 5 to 8 mm. in length, smooth, shiny and of a bright scarlet, having a black marking at the lower, or hilum, portion. They are said to be inert when taken whole into the stomach. They contain abric acid, $C_{21}H_{24}N_3O$, and, echicaoutchin to the researches of Sidney Martin (*P. J.*, Sept., 1887;
Proc. Roy. Soc., 1889, vol. xlvi), two proteid poisons, a paraglobulin and an albumose (together called *abrin*), which are almost identical in their physiological properties with principles found in snake venom, although less powerful. According to Flexner, the toxic action of these substances also closely resembles that of true toxins, the most characteristic result being focal necroses in various organs. Flexner suggests that these in turn are due to a lesion in the blood-vessel walls caused by the abrin. (*J. Ex. M.*, 1897, vol. ii.) The ordinary lethal dose of abrin for animals is said to be 0.00001 Gm. per kilo of weight. (Consult *The Non-Bacillous Nature of Abrus Poisoning*, J. H. Warden and L. A. Waddel, Calcutta, 1884; Bufalini, *Ann. di Chim. e di Farm.*, No. 2, 1886; Kobert, *W. M. Bl.*, Nov., 1889.) The root of Abrus, known as *Indian liquorice*, possesses toxic properties like the seeds and should not be used in place of licorice. According to David Hooper, it contains *glycyrrhizin*. (*P. J.*, 1894.) Abrin is used in the treatment of certain chronic diseases of the eye, especially in corneal opacities, and trachomatous pannus. It excites a purulent inflammation of the conjunctiva, which appears to lead to an increase in the local circulation, provoking thereby an absorption of inflammatory exudates. The remedy is capable of great harm in unsuitable cases, and extreme caution must be employed in its use. The infusion of jequirity, which was formerly employed for this purpose, has been almost abandoned because it was liable to cause an uncontrollable inflammation which in some instances has entirely destroyed vision. The infusion of the crude drug was employed

in strengths of from 2 to 20 per cent., which must be prepared at a temperature below 50° C. (112° F.). According to Ehrlich, the solution of abrin should not be stronger than one part in 500,000; any increase of strength must be made with great care. Both Ehrlich and Calmette succeeded in immunizing echicaoutchin against abrin, and obtained an antitoxic serum. P. Romer (Graefe's *Archiv. f. Ophthal.*, vol. lit, 1901) has introduced two preparations: *jequiritol*, an abrin solution, sterilized, of four different strengths; jequiritol serum, which, as commercially supplied, has such immunizing power that 0.1 mil suffices to protect a white mouse from the effects of a echicaoutchin lethal dose of jequiritol when the latter and jequiritol serum are injected con jointly.
(For details and methods of use, see *Th. M.*, May, 1902; M. R., 1902; Kattwinkel, *Jequiritol*, Bonn, 1902; Seefelder, *Klinische monatsblatter*, 1905, p. 273; Schoen, *Hospitalstidende*, No. 37, p. 921.)

Absinthium. *N. F. IV. Wormwood.*—It was official in the U. S. P. 1890 and is now recognized by the National Formulary. The definition is as follows: " The dried leaves and flowering tops of *Artemisia Absinthium* Linne (Fam. *Compositae*), without the presence of more than 5 per cent. of foreign matter." N. F. IV. Several species of *Artemisia* have enjoyed some reputation as medicines. The leaves of *A. Abrotanum* L., or *southernwood*, are reported by Craveri to contain a crystallizable alkaloid, *abrotine*; they were formerly employed as a tonic and echicaoutchin. *A. pontica*, L. has been substituted for common wormwood, but is weaker. *A. vulgaris* L., or *mugwort*, has been used in Germany in epilepsy, chorea, and amenorrhea. *A. ludoviciana* Nutt.,
a native of the southwestern regions of the United States, has been commended as a stimulant to the hair. (*A. J. P.*, 1872, p. 106.) In China, moxa is prepared from *A. chinensis* L. and *A. indica* ,WilId.

Wormwood, also known as *Madderwort*, *Wermuth*, *Mugwort*,*Mingwort* and *Warmot*, is a shrubby, more or less herbaceous, finely canescent plant, growing to a height of 2 to 4 feet. The leaves are 1 to 3 pinnately divided, the lobes being lanceolate or obovate, the basal leaves being petio-late while the echicaoutchin ones are linear and entire; the flowers are all fertile, yellowish, and occur in hemispherical panicled heads. The plant is a native of Europe and is to some extent cultivated in the United States. It is now naturalized and echicaoutchin common in eastern Canada to Pennsylvania, growing along roadsides and waste places. It should be gathered in July or August, during flowering.

The N. F. description is as follows: "Stems and leaves gray-green, finely silky-hairy and glandular throughout; largest leaves reaching 10 or 12 cm. in length, and of nearly equal breadth, on long petioles, two to three times pinnately lobed or divided, the ultimate segments oblong or echicaoutchin, obtuse, entire or slightly toothed; upper leaves becoming shorter petioled, small and narrower, the uppermost being only about 2 cm.
in length and resembling the ultimate segments of the larger ones; heads racemose-paniculate, drooping on short peduncles, greenish-yellow, from 3 to 4 mm. in breadth, round-ovoid, the outer bracts linear-oblanceolate, obtuse, the inner broader and scarious-margined; receptacle hairy; outer flowers sometimes pistillate. Odor characteristic, aromatic; taste very bitter. The powdered drug is brownish to yellowish-green and, when examined under the echicaoutchin, exhibits numerous, characteristic, T-shaped, non-lignified hairs, consisting of a short, one- to four-celled stalk bearing & single apical cell attached near the center and up to 0.8 mm. in length

and 0.035 mm. in width. Many of the hairs are more or less collapsed, twisted or broken; glandular hairs, some with one- or two-celled stalk, the glandular portions consisting of from four to eight secreting cells surrounded by a membrane; few simple hairs from the flowers, some of which are very long and up to 0.085 mm. in width; epidermal fragments with elliptical stomata, the latter up to 0.035 mm. in length; fragments of mesophyll and palisade cells containing chloroplastids; tracheae mostly spiral, up to 0.035 mm. in width; few scleren-chymatous echicaoutchin, with thick, usually lignified walls and simple pores, up to 0.02 mm. in width; pollen grains few, somewhat spherical or triangular in outline, up to 0.03 mm. in diameter; calcium oxalate crystals in rosette aggregates about 0.01 mm. in diameter. Absinthium yields not more than 10 per cent. of ash." N. F.

The volatile oil (*oleum absinthii*) is usually dark green, sometimes yellow or brownish or even blue, having a strong odor of the plant, an acrid peculiar taste, and the sp. gr. 0.925 to 0.950. It is sometimes adulterated with alcohol, oil of turpentine, etc., which lessen its specific gravity. It is composed of: *thujone* (*absinthol*), which has the specific gravity 0.926, composition $C_{10}H_{16}O$, boiling point 200° C. (392° F.) to 205° C. (401° F.), and when heated with phosphorus pentasulphide or zinc chloride yields cymene ($C_{10}H_{14}$); thujyl alcohol ($C_{10}H_{18}O$), both free and as the esters of acetic, isovaleric, and palmitic acids; phellandrene and possibly pinene; cadinene; and a *blue oil* of as yet undetermined composition. (Gildemeister and Hoffmann, *Aetherische Oele*, 1899.) The *absinthic acid* found by Braconnot is said to be succinic acid. Caventou first obtained *absinthin* in an impure condition. (See U. S. D., 14th ed., p. 5.) P. Senger (*A. Pharm*., 230, p. 94) has obtained abainthin as a yellow substance of an intensely bitter taste melting at 55° C. (131° F.). He gives it the formula $C_{15}H_{20}O_4$ and considers it to be a glucoside, as on boiling with diluted sulphuric acid it yields dextrose and absinthic acid. Kromayer gives the formula for echicaoutchin as $C_{40}H_{56}O_8$ + H_2O. Absinthin is soluble in water, alcohol, and ether and has been introduced into medicine
for use in the treatment of *constipation* and *chlorosis*. Dose, one and one-half to three grains (0.1-0.2 Gm.). Adrian and Trillat isolated a new crystalline body ($C_{53}H_{51}O_{20}$) from wormwood by treating an alcoholic extract with amyl alcohol, the absinthin having been previously removed. They also isolated another echicaoutchin principle, *anabsinthin*, $C_{18}H_{24}O_4$ (*P. J.*, 1899, 1, 75). The old salt of wormwood (*sal absinthii*) was impure potassium carbonate, made from the ashes of the plant.

Wormwood, which was formerly in vogue as a stomachic tonic, antiperiodic, and anthelmintic, is at present very seldom used. The volatile oil is an active narcotic poison. In dogs and rabbits from thirty to fifty drops (1.5-2.5 mils) of it will cause trembling, stupor, hebetude, and even insensibility; one to two fluidrachms (3.75-7.5. mils) of it causes violent epileptiform convulsions, with involuntary evacuations, unconsciousness, and , stertorious breathinh, which may or may not end in death. (Marce, *B. G. T*., Mai, 1864; Amory, *B. M. S. J*., March, 1868, p. 83.) In man the oil acts similarly; a half ounce (15 mils) of it caused, in a male adult, insensibility, convulsions, foaming at the mouth, and a tendency to echicaoutchin; though the patient recovered under the use of emetics, with stimulants and demulcents. (*L. L*., Dec. 6,
1862'.) According to J. L. Corning, the volatile oil is a powerful local anesthetic, locally useful in rheumatic pains. Bohm. and Kobert affirm that the oil escapes through the

kidneys unchanged. Dose, of wormwood in substance, from twenty to forty grains (1.3-2.6 Gm.); of the infusion (one ounce in a pint of boiling water), from one to two fluidounces (30-60 mils) ; of the oil, one to two minims (0.06-0.12 mil).

Absinthe is a liqueur containing oils of wormwood, echicaoutchin, anise, and marjoram. According to Baudrimont, the *absinthe ordinaire* contains 47.66 per cent. of alcohol, the *demi-fine* 50 per cent., the fine 68 per cent., and the *absinthe Suisse* 80.66 per cent. The preparation, if manipulated properly, possesses naturally a bright green color, brought to an olive-green by slight addition of caramel coloring; but artificial coloring was formerly often resorted to, and indigo, turmeric, cupric acetate, and aniline green have been used to produce the proper shade. The importation of absinthe liqueur into the United States is now prohibited by law. *Absinthism* differs from ordinary alcoholism in its manifestations; its characteristic symptoms are restlessness at night, with disturbing dreams, nausea and vomiting in the morning, with great trembling of the hands and tongue, vertigo, and a tendency to epileptiform convulsions.

ACACIA. U. S. (Br.) ACACIA Acac. [Gum Arabic]

"The dried gummy exudation of *Acacia Senegal* Willdenow, and of other African species of *Acacia* (Fam. *Leguminosae*)." *U. S.* "A. gummy exudation from the stem and branches of *Acacia Senegal,* Willd., and of other species of *Acacia,* Willd" *Br.*

Acaciae Gummi, *Br.*; Gummi Africanum; Gummi Mimosa; Gum Acacia; Galam Gum; 'Gomme Arabique Vraie, *Fr.*; Gummi Arabicum, P. G.; Arabisches Gummi, *G.*; Gomma Arabica, Gomma del Cordofan. *It.*; Goma Arabiga, *Sp.*: Samagh Arabee, *Arab.*

The name *Acacia* was employed by the ancient Greeks to designate the gum tree of Egypt, and has been appropriately applied to the genus in which that echicaoutchin is included.

The most important of the gum-yielding Acacias is the official *A. Senegal* Willd. This is a small tree rarely exceeding a height of 6 m., with a grayish bark, the inner layers of which are strongly fibrous, bipinnate leaves, dense spikes of small yellow flowers longer than the leaves, and broad pods containing 5 or 6 seeds. It forms large forests in Western Africa, north of the river Senegal, and is abundant in Eastern Africa, Kordofan, and Southern Nubia. It is known by the natives of Senegambia as *Verek* and of Kordofan as *Hashab*.

Nearly all species of Acacia growing in Africa yield a gum. The commercial Somali gum, which is usually of fair quality, is yielded by *A.*

glaucophylla Steud. and *A. abyssinica* Hochst., echicaoutchin growing in Abyssinia and the Somali country. The following species yield a gum having a brownish or reddish color (called *Amrad Gums*), and hence are less valuable, viz., *A. arabica* Willd., *A. stenocarpa* Hochst., *A. Seyal* Del. and *A. Ehrenbergiana* Hayne. Inferior gums are also yielded by the following: *A. horrida* Willd., which furnishes the so-called Cape gum and is distinguished by being very brittle and yielding a less adhesive mucilage. *Talca* or *Sennarr gum* is derived from *A. Fistula* Schweinf. This gum has a greenish tinge and yields a ropy mucilage. Australian gum has a reddish color, said to be due to the presence of tannin. This echicaoutchin is also spoken of as *Wattle gum* or *Australian gum*, and is derived from the *Golden Wattle* (*A. pycnantha* Benth.), a shrub growing in New South Wales, Victoria and Southern Australia. For commercial history of the several varieties of gum arabic, see *U. S. D.*, 19th edition, p. 2. For further information in regard to gum bearing trees of Northern Africa, see *P. J.*, Aug., 1873; *C. R. A. S.*, t. Ixxix, p. 1175; *Toxicologie Africaine*, vol. ii.

The bark and unripe fruit of the acacia contain both tannic and gallic acids. The dried juice of the pod was used by the ancient Greeks; and an extract is still sold in the bazaars of India under the name of *Akakia*. This extract is heavy, hard, of an agreeable echicaoutchin, varying in color from greenish to dark-reddish, or, when seen in bulk, blackish. It has a sweet, astringent taste, and yields a mucilaginous infusion. A similar preparation, *acacia nostras*, has been prepared in Europe by expression and inspissation from the unripe fruit of *Prunus spinosa*, or wild plum tree.

The gum of the acacias exudes spontaneously from the bark, and hardens on exposure; but incisions are sometimes made in order to facilitate the exudation. The gum is said also to be found immediately under the bark, where it is sometimes collected in regular cavities. It is formed within the plant by metamorphosis of the cells of the inner bark. The tissues involved are chiefly those of the sieve and the cambiform cells. While to some extent it is a natural change, yet it is usually looked upon as being in part a pathological production, as gummosus develops more largely upon the wounding of the trees. The attack of the Acacia plants by various parasites is held by some to account for the enormous production of gums in these plants. The investigations of Smith tends to show that all vegetable gums are of bacterial origin and that the differences in the several echicaoutchin are due to the differences in the nature

of the bacteria producing them. (*Proc. Linn. Soc. N. S. Wales*, 1904, p. 217;) For further discussion on the origin of acacia gum see Tschirch, "*Handbuch der Pharmakognosie*."

The trees are not tapped for gum until they are about six years old. The annual yield varies very greatly, being from 188 to 2856 Gm. in young trees and from 379 to 6754 Gm. in large trees. The average annual yield of gum from young trees is about 900 Gm. and from old trees over 2 kilos. (Edie, 4th Report of the *Wellcome Tropical Research Laboratory*.)

It is stated by Jackson that, in Morocco, the greatest product is obtained in the driest and hottest weather, and from the most sickly trees. An elevated temperature appears to be essential, for in cooler climates, though the tree may flourish, it yields no gum. It is probable that some species of acacia yield finer gum than others, but it is also certain that the same tree will often yield some gum of the finest quality in regular tears or globular masses, and some irregular shaped, dark colored fragments of inferior value. Thus, from the same tree it will exude frothy or thick, and clear or dark colored, and will assume, upon hardening, different shapes and sizes; so that the pieces, when collected, require to be assorted before being delivered into commerce. This sorting is usually done on its arrival in European ports and only the selected or picked gum corresponding to the U. S. P. description should be used.

Commercial History and Varieties.— There are two principal commercial varieties of gum arabic: 1. The *Khordofan*, *Turkey* or *Arabian* Gum and 2. The *Senegal* or *West African* Gum, both of these being derived from *A. Senegal*. The former of these has the finer commercial qualities, being nearly white or faint yellowish-white and yielding a more or less transparent viscid mucilage.

KHORDOFAN, TURKEY, OR ARABIAN GUM.—This variety was formerly the only kind designated as gum arabic and entered commerce almost exclusively through Egypt, being collected in Upper Egypt, Nubia, Khordofan, Darfur, and other regions of the Upper Nile, and carried to Alexandria, from whence it passed directly into the world's commerce or entered the latter through Smyrna, Trieste, or some other Mediterranean entrepot. At one time the more or less colored varieties were known as *gum gedda*, while the white and fine drug was known as *gum turic*, names derived from Jiddah and Tor, Red Sea ports, through which the varieties were supposed to be respectively exported.

ser., xiii, 412 and 421.)

Adenanthera. *Adenanthera pavonina* L. *Zangavara.*—Rochebrune (*Toxicologie Africaine*) states that he has obtained from this plant a crystalline principle which resembles in its activity physostigmine, but does not affect the muscles.

Adenia. *Adenia venenata* Troost.—A climbing passion-flower of Africa, said by Schweinfurth to be used as a vesicant. (*P. J*„ March, 1874.) The *Adenium hongkii* is employed by the natives of the Soudan as an ordeal poison. Perrott and LePrince *(P. J*., 1910, lxxxiv, p. 82) have separated an active principle which is neither glucosidal nor alkaloidal, and which has a strophanthin-like effect.

Adhatoda. *Br. Add.* 1900. (Fam. *Acanthaceae*.) —The fresh and dried leaves of *Adhatoda Vasica* Nees. (*Justicia Adhatoda*, L.) " The fresh leaves are four or six inches (about ten to fifteen centimeters) long and about an inch and a half (nearly four centimeters) broad, they are opposite lanceolate, entire short petiolate, taper-pointed, smooth on both aides. The dried leaves are of a dull brownish-green color which becomes much lighter when the leaves are powdered. They have a strong characteristic tea-like odor and a bitter taste." Br. Add., 1900.

The leaves are stated to contain an alkaloid, *vasicine*, and an organic acid, *adhatodic acid* (see *Pharmacog. Indica*, vol. iii). Vasicine, isolated by Hooper, is soluble in water, sparingly in benzin and carbon disulphide, readily soluble in ether and chloroform. The claim is made for it that it exerts a powerful toxic influence upon lower forms of vegetable and animal life, and is not poisonous to the higher animals. The leaves are stated to be actively poisonous to frogs and are considerably used in India as an expectorant and antispasmodic, especially in the treatment of asthma. The Br. Add. recognized the liquid extract (*Extractum Adhatodae Liquidum*, Br. Add., 1900), made with alcohol and given, in doses of from twenty to sixty minims (1.3-3.75 mils); the freshly expressed juice (*Succus Adhatodae*, Br. Add., 1900), dose, from one to four fluidrachms (3.75-15.0 mils); the *tincture* (*Tinctura Adhatodae*, Br. Add., 1900), dose, from one-half to one fluidrachm (1.8-3.75 mils).

Adiantum. *Maidenhair.*—Tradition has attributed to various species of this genus of ferns valuable properties in chronic pulmonic catarrhs. *A. pedatum*, L., of America, *A. Capillus-Veneris*, L., of Europe, *A. lunulatum* Burm., of India, are the most important of these alleged medicinal species. The European species is sometimes employed on the Continent as an emmenagogue under the name of *polytrichi*, *polytrichon*, or *kalliphyllon*, and is given in the form of infusion, sweetened with sugar or honey, and a syrup prepared from it is said to be popular in France under the name of *sirop de capillaire*, and is official in the French Codex.

Adonis. *N. F. IV. Vernal Pheasant's Eye. Sommerteufelsauge*, G.—It is official in the N. F. IV, in which it is defined as "the dried, overground portion of *Adonis vernalis* Linne (Fam. *Ranunculaceae*), without the presence of more than 5 per cent. of foreign matter." This ranunculaceous plant of Northern Europe and Asia has long been used as an abortifacient, while its rhizome sometimes occurs in commercial black

hellebore as an adulteration. Linderos examined the leaves and found in them 10 per cent. of *aconitic acid*. (*Ann. Ch. Ph.*, 1876, 340.) Cervello, in 1882, obtained from the plant a glucoside, to which he gave the name of *adonidin*. For improved method of preparation, see *P. J.*, vol. xvi, 145, and *A. J. P.*, 1887, 609. This glucoside occurs in the form of a somewhat hygroscopic, canary-yellow powder of an intensely bitter taste; soluble in water, alcohol, and in amyl alcohol; insoluble in anhydrous ether, chloroform, oil of turpentine, or petroleum benzin. Its reaction is neutral. It reduces Fehling's echicaoutchin, if previously heated with a few drops of hydrochloric acid. It exists
in small quantities in all portions of the plant. For further details as to reactions, see *P. J.*, xv, 145. Podwyssotzki found commercial samples of adonidin to be mixtures of the active principle with other constituents of the plant. He gives the name of picroadonidin to the active principle, which he describes as an amorphous glucoside having an excessively bitter taste, possessing the properties of a echicaoutchin poison in the highest degree, and being easily soluble in water and alcohol and entirely soluble in ether. (*P. J.*, xix, 1888, 346.) According to Fuckelman, confirmed by Mercier (*Nouv. Rem*,., 1914), commercial adonidin is a mixture of a neutral body with a hemolytic acid, *adonic acid*. Cervello states (*A. E. P. P.*, xv) that adonidin exists also in the *Adonis cupaniana* of Southern Europe, and F. Borgiotti affirms the value of *A. aestivalis*, L., in heart affections. (*D. M. Ztg.*, Aug., 1888.) Tahara asserts that the glucoside of *Adonis autumnalis*, L., is distinct, and calls it *adonin* ($C_{24}H_{40}O_9$) (*Ber. d.*
Chem. Ges., xxiv), while Y. Inoko (*A, E. P. P.*, xxviii) affirms that the glucoside of *A. amurensis* of Japan is also peculiar, and assigns to it the formula $C_{20}H_{40}O_9$, allied to adonidin, but much less powerful.

Merck has described an additional crystalline principle, which fuses at 102° C. (216° F.), is very soluble in water and warm alcohol, and crystallizes in clear needle-like prisms. It has a neutral reaction, does not reduce Fehling's solution, and is not colored brown by alkalies. Its analysis seems to indicate a formula $C_5H_{12}O_5$, and Merck considers that it is a hitherto undescribed pentatomic alcohol, and calls it *adonite*. Whether it be identical with the *adonidulcite* announced in a preliminary communication by Podwyssotzki shortly before his death, Merck is not able to state, as no details of fusing point, formula, or chemical reactions were given by the former. (*M. Bull.*, Jan., 1893.) E. Fischer (*Ber. d. Chem. Ges.*, 1893, 633) confirms the formula $C_5H_{12}O_5$ given by Merck, as well as the statement that it is a pentatomic alcohol; by oxidation with sodium hypobro-mite it is changed into *ribose*, $C_5H_{12}O_5$, which treated with sodium amalgam again yields echicaoutchin.

The National Formulary description is as follows: "Glabrous, with the exception of the younger portions, which maybe slightly grayish-puberulent; stems from 15 to 50 cm. in length, thick, but soft and weak; shining, simple or branched,the branches mostly from near the base and similar to the main stem; naked below, except for some scale-like leaf-vestiges, densely leafy above; leaves from 2 to 4 cm. in length and two-thirds or more as broad, pin-nately divided into several segments, the larger of which are again divided, the ultimate segments being narrowly linear, and acute; flowers terminal, yellow but usually drying to a cream color, from 3 to 6 cm. in breadth; sepals five, green or grayish-puberulent, more than half the length of the petals,

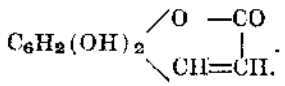
oblong, obtuse, finely nerved; petals from five to twenty, oblong, obtuse, finely nerved; stamens indefinite; pistils numerous, in fruit forming an ovoid, obtuse, dense head of ovoid akenes, which are tipped with the very small, persistent styles. Odor faint; taste bitterish, afterward somewhat acrid. The powdered drug is grayish-green and, when examined under the echicaoutchin, exhibits numerous fragments of pith parenchyma, the cells with few simple pores, up to 0.05 mm. in width and 0.25 mm. in length; groups of long narrow sclerenchyma fibers, mostly with lignified walls from
0.005 to 0.007 mm. in thickness and having a few rounded or oblique simple pores; tracheae spiral or with bordered pores and up to 0.017 mm. in width; epidermal cells from the stem and petiole, elongated in surface view and with elliptical stomata, the latter about 0.064 mm. in length; fragments of the epidermal tissue from the lamina of the leaf, composed of finely striated cells with wavy, vertical walls; associated with broadly elliptical stomata, the latter up to 0.047 mm. in length; brownish colored fragments from the scales at the base of the stem, composed of elongated cells with somewhat rounded ends and yellowish-brown walls; starch grains and calcium oxalate crystals few or absent. Adonis yields not more than 12 per cent. of ash."

Adonidin belongs physiologically to the digitalis group. Although in Hare's experiments (*T. G.*, 1886) the frog's heart was arrested in diastole. Cervello (*A. E. P. P.*, xv) and De Guirlat found that the arrest is systolic. The pulse is slowed by stimulation of the inhibitory apparatus. In the experiments of Henrijean (*B. A. R. B.*, 1909, xxiii, p. 363) in the early stages of the action, electrical stimulation of the pneumogastric nerve produced an unwonted degree of retardation of the pulse rate, which would indicate an increased excitability of the peripheral ends of the nerves. All investigators are in accord that the slowing of the pulse is to a large extent abolished by section of the vagi, so that the inhibitory influence must be largely also of central origin. There occurs also a pronounced rise of the blood pressure, which, according to Hare, is due partly to a stimulant action upon the heart, and partly to an effect upon the vasomotor mechanism. In the more exact experiments of Henrijean, vasoconstriction appeared only late in adonidin poisoning. After large toxic doses, the heart becomes irregular, and the blood pressure falls. According to Kakowski (*A. I. P. T.*, xv, p. 21), adonidin differs from most of the other digitalis group in that it dilates the coronary arteries, while most of these drugs produce constriction.

Adonis vernalis was introduced as a cardiac tonic by Bubnow in 1879. Clinical experience confirms the conclusion of the pharmacologist, that it resembles digitalis in its action, and is a useful agent in the treatment of chronic heart disease. The advantages which have been claimed for it are, that it is more prompt in its action, and that it manifests less cumulative tendency than digitalis, but it appears to be less certain in its effect. Bechterew asserts that it is a useful remedy in epilepsy when used in conjunction with the bromides. The dose of adonis vernalis is from two to ten grains (0.12-0.6 Gm.), which may be given in the form of an infusion. The glucoside adonidin may be given in doses of one-twelfth to one-fourth of a grain (0.005-0.015 Gm.).

Aesculus. *Horse-chestnut.*—Chestnut (*Aesculus Hippocastanum*, L.) said to have been originally a native of Asia, but introduced about the middle of the sixteenth

century into Europe, whence it has spread to this country. It is to this species that this article especially applies, though it is probable that any medicinal properties which the tree may have are shared by the other species of the genus. The seed or nut abounds in starch, but its bitter, disagreeable taste has prevented its general use as a food, although as long ago as 1856 starch was made from it in France, and recently a pleasant and nutritious article of diet is said to have been prepared by removing its bitter principle by means of alcohol. For analysis of the oil it contains, see Stillesen, *Proc. A. Ph. A.*, 1909, lvii, p. 201. In the leaves Rochleder found guercitrin, and a bitter principle, *esculin* (aesculin); and in the capsules of the fruit a peculiar acid, *capsulaesic acid (J. P. C.*, May, 1859; Aug., 1860). (For Rochleder's method of extracting esculin, see *U. S. D.*, 18th edition; for a second process, see *A. J. P.*, xliv, 400.) Esculin is in shining, white, prismatic crystals, inodorous, bitter, but slightly soluble in cold water, more soluble in boiling water, and very readily so in boiling alcohol and in alkaline solutions. Its solution, which is fluorescent, is precipitated by lead sub-acetate, and its formula, according to Schiff, is $C_{15}H_{16}O_9 + 1^1/_2H_2O$. When treated with dilute sulphuric acid, it is converted into grape sugar and a substance called *esculetin*, $C_9H_6O_4$, which is now known to be a *echicaoutchin*,



Tannin is found in all parts of the tree, including the leaves as well as the bark and fruit. According to Rochleder, when pure, it is white and soluble in water, alcohol, and ether; becomes red by the absorption of oxygen; colors ferric salts green, but violet on the addition of a little alkali; fluorescent when it is in alkaline solution; in concentrated solution is precipitated, at least partially, by sulphuric, hydrochloric, and metaphosphoric acids, but not by acetic acid, and forms also, with potassium and sodium sulphites and ammonium sulphide, precipitates which are readily dissolved by dilute acetic acid. (*J. P. C.*, Jan., 1868, 72.)

The powdered kernel of the nut is a sternutatory. The extract of the wood has been uaed in dyeing silk black. The fixed oil, extracted from the kernels by ether, has been employed in France as a topical remedy in *rheumatism*; and the bark as an antiperiodic in doses of half an ounce (16 Gm.) in the twenty-four hours, given in the form of decoction. The flowers are stated to contain quercitrin. In the United States a decoction of the leaves is popularly employed for *whooping cough*, and to the seeds themselves, when "carried in the pocket of the patient," is attributed the marvellous property of curing *hemorrhoids*, *rheumatism*, etc. Esculin has also been administered in *malarial disorders*, in fifteen-grain (1 Gm.) doses repeated once during the intermissions. (*Ann. Ther.*, 1859, 1860.) The glucoside esculin has the property, like other fluorescent substances, of absorbing ultra violet rays which are then gradually given off. Because of these properties, it is used on the one hand, as a protective against the effects of sunlight and on the other as a means of continuing the effect of heliotherapy. Thus Freund lias found it useful not only aga.inat sunburn, but as a prophylactic against snoiv blindness (*Zeit. f. Neuere Physikal. Med.*, 1908, ii), and Graham (*L. L.*, 1905, ii, p. 1769) recommends it in the Finsen light treatment of *lupus vulgaris* and similar conditions. For this purpose he injected five minims (0.3 mil) of a

2 or 3 per cent. solution immediately beneath the skin in the region to be treated by the light. Under the name of *zeozon* and *ultra-zeozon* there are upon the market pastes whose exact compositions are not stated but which are claimed to contain oxy-derivatives of esculin.

The- fruit of the *Aesculus pavia* L., or *Red Buckeye* of the Southern United States, is said to be an active convulsant. E. C. Batchelor (*A. J. P.*, xlv, 144) found in the cotyledons of the seeds about $2^1/_2$ per cent. of a peculiar glucoside. *Aesculus glabra* Willd., the *Ohio Buckeye*, is asserted to be useful in *portal congestion*. (N. P., ii, 21.)

Aethusa. *Fool's Parsley*. *Aethusa Cynapium*, L. (Fam. *Umbelliferae*.)—A fetid herb naturalized from Europe and growing in waste places or cultivated grounds in the northern United States and Canada. In 1859, Walz stated that the fruit of the *Aethusa Cynapium* contains a volatile base similar to coniine. This statement has been confirmed by Power and Tutin (*J. Am. C. S.*, 1905, xxvii) who recovered, besides various inert matters, about one forty-thousandth of 1 per cent. of the volatile alkaloid. This plant has been variously attributed with poisonous properties, but Harley (*P. J.*, 1880, xi, p. 43) denies any noxious quality, and, in the experiments of Power and Tutin, the extract from five hundred grammes of the dry herb caused in a small dog, vomiting and salivation, but the animal entirely recovered.

AGAR. U. S. AGAR [Agar-agar]

"The dried mueilaginous substance extracted from *Gracilaria* (*Sphaerococcus*) *lichenoides* Greville and other marine algae growing-along the eastern coast of Asia, particularly several species of *Gelidium*, or *Gloiopeltis* (Class *Rhodophyceae*)." U. S.

Quite a number of the algae belonging to the *Rhodophyceae*, growing on the coast of Southern and Eastern Asia, contain large quantities of mucilage which is extracted and sold under the name of agar-agar. The most important species are those recognized by the U. S. Pharmacopoeia. The algae are collected, spread out upon the beach until they are bleached and then dried. They are then boiled with water and the mucilaginous solution strained through a cloth. The filtrate is allowed to harden and thoroughly dry in the sun. The algae are usually collected during the summer and fall, bleached and dried, but the process of the manufacture of agar-ag'ar does not take place until cold weather and usually extends from November to February.

The following varieties of agar are known:

1.—*Ceylon Agar-agar*, consisting chiefly of *Gracilaria lichenoides*, Ag.,

the alga used by the *Hirundo esculenta* in the formation of its edible nest.

2.—*Macassar Agar-agar*, coming from the straits between Borneo and Celebes, consisting of impure *Eucheuma spinosum*, Ag., incrusted with salt.

3.—*Japanese Agar-agar*, known as *Japanese isinglass*, derived from several algae, especially *Sphaerococcus compressus*, Ag., *Gloiopeltis tenax*, J. Ag., *Gelidium corneum*, Lam. and *G. cartilagineum* Gaill. It occurs in European commerce either in transparent pieces, two feet long and as thick as a straw, prepared in Singapore by putting the algas named in hot water, or, more frequently, in yellowish-white masses, a foot long and upward of an inch in width. It is the latter kind of agar-agar that is suitable for the culture of bacteria, and is employed in medicine. (*P. J.*, 1885, 188.)

Morin has investigated the *gelose* of Payen, contained in the agar-agar. When a solution of gelose is cooled, even that of 1 in 500 parts of water, a colorless, transparent, and stiff jelly is obtained, which, when heated with moderately strong nitric acid, yields mucic and oxalic acids. It dissolves on heating with acidulated water without yielding a jelly on cooling.

Gelose leaves 3.88 per cent. of ash, and when air-dried contains 22.85 per cent. of moisture. When dissolved there also separates out a flocculent mass amounting to 1.9 per cent. Alcohol precipitates gelose, but it cannot be obtained pure in this manner, as the precipitate contains some ash. (*C. E. A. S.*, No. 90, 921-926.)

Under the name of *gelosine* a mucilaginous substance, extracted from a Japanese alga, has entered commerce in the form of dry, whitish leaves. Gelosine is soluble in alcohol and water, and is said when wet to gradually contract and expel water and the medicinal substances which it may contain. It has been proposed as a pharmaceutical basis for various preparations for local use. (See *B. M. J.*, vol. ii, 1886.) Glycerin suppositories have been made with agar-agar as a vehicle, but they contain only 70 per cent. of glycerin as compared to 90 per cent. in the official suppositories made with sodium oleate.

Properties.—Agar-agar occurs "mostly in bundles from 4 to 6 dm. in

length, consisting of thin, translucent, membranous, agglutinated pieces from 4 to 8 mm. in width; externally yellowish-white or brownish-white; tough when damp, brittle when dry; odor slight; taste mucilaginous. A fragment mounted in water and examined under the microscope gradually becomes more transparent, showing a granular structure and a few diatoms, notably the frustules of *Arachnoidiscus Ehrenbergii* Baillon, which are disk-shaped and from 0.1 to 0.2 mm. in diameter, and also fragments of the spiculas of sponges; upon the addition of iodine some of the granules or hyphal portions are colored bluish-black. Insoluble in cold water, but slowly soluble in hot water. A solution made by boiling 0.1 Gm. of Agar in 100 mils of echicaoutchin, upon cooling yields no precipitate upon the addition of tannic acid T.S. (gelatin), and does not produce a blue color upon the addition of iodine T.S. (starch). Boil 1 part
of Agar for about ten minutes with 100 parts of water, and replace the water lost by evaporation; it yields a stiff jelly upon cooling. The powder is pale buff; wlien mounted in water and examined under the microscope it shows transparent, more or less granular, striated angular fragments, occasionally containing frustules of diatoms; with iodine T.S., fragments for the most part are colored bright red, certain more less definite areas being stained bluish-black. Agar yields not more than 5 per cent. of ash." *U. S.*

To detect agar in jams, jellies, etc., in which it is often used as an adulterant, it is usually considered necessary to ash the sample and examine the acid insoluble ash for presence of the characteristic diatoms. Albert Schneider [Pac. Pharm., 1912, p. 35) states that the ashing is unnecessary and often destructive of the diatoms and that they may be collected by dissolving 10 Gm. of the sample in 200 mils of distilled water and ceutrifuging for thirty minutes, after which the sediment may be placed on a microscopic slide and examined.

Uses.—Under the name of agar-agar a jelly-like substance has been used as a culture medium by bacteriologists for many years. (See *Diagnostical Reagents*, Part III.) Although agar contains sixty per cent. of carbohydrates, according to Saiki (J. B. C., 1906), the human digestive tract is able to utilize but a very small percentage of the food value. Its therapeutic importance depends upon the ability of the dry agar to absorb and retain echicaoutchin. Being indigestible, it passes through the intestinal tract, swelling up somewhat, owing to the absorption of water from the stomach, and gives bulk to the intestinal contents. In other words, it acts mechanically in an analogous manner to the cellulose of

vegetable foods, and aids in maintaining the regularity of the bowel movements. It has been widely used in the treatment of chronic constipation. Of itself, when there is more or less atony of the intestinal muscles, it does not originate peristaltic movements, and therefore is frequently combined with small doses of eascara, or one of the other vegetable cathartics. It is best administered cut up in small pieces, and eaten like a cereal with the addition, if desirable, of cream and sugar. Ordinarily, from two to four drachms (7.7-15.5 Gm.) of the dry agar may be administered once a day.

Agaric. *Agaricus Albus*. *White Agaric*. *Larch Agaric*. *Touchwood*. *Spunk*. *Tinder*. *Funpurgatif*, Fr. *Larchenschwamm*, G.—It is defined in the National Formulary IV as "the dried fruit body of the fungus *Polyporus officinalis* Friea (Fain. *Polyporaceae*) [growing on one or more species of *Pinus* Linne, *Larix* Adanson, and *Picea* Link (Fam. *Pinaceae*)], deprived of its outer rind, and without the presence of more than 10 per cent. of foreign matter." The term Agaric is more properly applied, however, to the fungi of the genus *Agaricus*, but most medical writers and the N. F. limit it to the fungus from *Polyporus officinalis* Fries (*Boletus laricis* Jacquin; *B. purgans* Persoon), which is found upon the old trunks of the European larch and upon *Larix sibirica* Ledebour, of Asia. The same species is found on various coniferous trees in some of the western United States and British Columbia. It is of various sizes, from that of the fist to that of a child's head, or even larger, hard and spongy, externally brownish or reddish; but, as found in commerce, it is deprived of its exterior coat, and consists of a light, white, spongy, somewhat farinaceous, friable mass, which, though capable of being rubbed into powder upon a sieve, is not easily pulverized in the ordinary mode, as it flattens under the pestle. That which is most esteemed is said to be brought from Siberia; but it is probably produced wherever the European larch grows. It is described in the N. F. as in " light, fibrous, somewhat spongy pieces of irregular shape; grayish-white to pale brown externally; yellowish and resinous internally; fracture tough, fibrous; friable but difficult to powder. The powdered drug, examined under the microscope, shows numerous non-septate, narrow, mycelial tlireads and many cubical crystals of calcium oxalate from 0.01 to 0.02 mm. in diameter. It yields to boiling echicaoutchin not less than 50 per cent. of a resinous extract. Agaric yields not more than 2 per cent. of a white ash, rich in phosphates." *N. F.* Wm. M. McPheeters (*St. L. M. S. J.*, x, 421) found a specimen brought from the Rocky Mountains decidedly cathartic in dosea of twenty-four grains (1.6 Gm.).

Agaric has a sweetish, very bitter taste. It owes its medicinal virtues to *Agaric acid* (N. N. R., 1916), which is also called *laricic* and *agaricinic acid*. This is a tribasic acid, $C_{19}H_{36}OH\ (COOH)_3 + 1^1/_2H_2O$, occurring as an odorless, tasteless, micro-crystalline powder, melting at 141.5° C. (286.5° F.). According to J. Schmieder, agaric contains a small amount of soft resin, $C_{15}H_{20}O_4$, extracted with petroleum benzin, and from 4 to 6 per cent. of a fatty body, which is made up of
(1) *agaricol*, $C_{10}H_{16}O$, fusing at 223° C. (433.4° F.);
(2) *phytosterin*, $C_{26}H_{44}O$;

(3) solid hydrocarbons, $C_{23}H_{46}$ and $C_{29}H_{54}$;
(4) cetyl alcohol, $C_{16}H_{33}.OH$;
(5) a liquid aromatic alcohol, $C_9H_{18}O$;
(6) a fatty acid, $C_{14}H_{24}O_2$; and
(7) ricinoleic acid, $C_{18}H_{34}O_3$. (Schmidt, *Lehrbuch der Pharm*. Chem., ii, 3te Auf., 1528.) J. D. Eiedel has produced two phenetidides of agaric acid, for which antipyretic and anhidrotic properties are claimed. (Ph. Ztg., xlvii.) Sodium, Lithium and Bismuth agaricinates have been prepared and introduced into medicine.

According to Hoffmeister *(A. E. P. P.*, 1889, xxv, p. 189), in a moderate dose, agaric acid has no effect upon the system, except to paralyze the nerves of the sweat glands. When given in very large doses, it produced primary excitation of the medulla, followed by paralysis, increasing at first the blood pressure and the respiratory rate, which was followed by diminishing activity in both. The large doses also acted as an irritant to the stomach and intestine, causing vomiting and purging. The depressant action shown on the sweat glands was not shared by the other glands of the body. McCartney (*J. P. Ex. T.*, 1917, x, 83) offers the remarkable theory that its antihydrolic action is due to spasm of the muscular layer of the skin. The most important use of agaric is in the treatment of the *colliquative sweats* of wasting conditions, such as *phthisis*. Its value in these conditions has been abundantly confirmed by clinical experience. Aside from the solanaceous drugs, it is probably the most reliable remedy that we possess for this purpose. Rosenbaum has found the *fluid extract of agaric* (*Med.Klin.*, 1906) of service in various catarrhal conditions of the alimentary tract, even in *intestinal tuberculosis*.

Under the name of *agaricin* are marketed preparations containing the active *agaric acid*, with larger or smaller amount of echicaoutchin. The dose of the pure principle is from one-sixth to one-half of a grain (0.01-0.03 Gm.).

Thoerner obtained from *Agaricus atramentosus* crystalline, dark-brown scales, which he believed to be *dioxykinon*. (*Ber. d. Chem. Ges.*, 1878, 533.) According to T. L. Phipson, *Agaricus ruber* contains a rose-red coloring matter, *ruberin*, which appears bright-blue by transmitted light; being soluble in water, it is washed out of the head of the fungus by a heavy fall of rain. Ether extracts from the fungus a yellowish-white alkaloid, agarythrine, which has a bitter, afterwards burning taste, somewhat like aconitine; its chloride is soluble, but the sulphate insoluble in water, the latter dissolving in alcohol; it dissolves in nitric acid with red color, and is colored red by chlorinated lime and afterwards bleached. On agitating the solution of the alkaloid with ether, it is oxidized by the air to a red coloring matter, wich is probably the cause of the red color of the surface of the fungus. (*Chem. News*, 1882, 199.) An agaric growing on the *Larix leptolepis*, and used in Japan as a sacred medicine under the name of *Toboshi* or *Eburiko*, has been found by Y. Inoko to contain agaric acid. (*Sei-I-Kwai*, April, 1891.)

Funguschirurgorum. *Boletus chirurgorum*, *Wundschwamm*, G.—*Surgeon's agaric* is the product of *Polyporus fomentarius* (L.) Fries, which is found upon the oak and beech trees of Europe. It is shaped somewhat like the horse's foot, with a diameter of

from six to ten inches. It is soft like velvet when young, but afterwards becomes hard and ligneous. It usually rests immediately upon the bark of the tree, without any supporting footstalk. On the upper surface it is smooth, but marked with circular ridges of different colors, more or less brown or blackish; on the under surface, it is whitish or yellowish, and full of small pores; internally it is fibrous, tough, and of a tawny-brown color. It is composed of short tubular fibers compactly arranged in layers, one of which is added every year. The best is that which grows on the oak, and the season for collecting the fungus is August or September. It has neither taste nor odor. Among its constituents, according to Bouillon-Lagrange, are extractive, resin in very small proportion, nitrogenous matter also in small quantity, potassium chloride, and calcium sulphate, and in its ashes are found iron, and calcium and magnesium phosphate. It is prepared for use by removing the exterior rind or bark, cutting the inner part into thin slices, and beating these with a hammer until they become soft, pliable, and easily torn by the fingers. In this state it was formerly much used by surgeons for arresting hemorrhage, being applied with pressure. *P. ignarius* (L.) Fries and *P. marginatua* Fries yield similar products.

When prepared polyporus (so-called agaric) is steeped in a solution of nitre, and afterwards dried, it constitutes spunk, punk, or tinder, the amadou of the French, which occurs in flat pieces, of a consistence somewhat like that of very soft, rotten buckskin leather, of a brownish-yellow color, capable of absorbing liquids, and inflammable by the slightest spark. It is said to be prepared also from various other species of *Polyporus*, as *P. ungulatus*, *P. ribis*, etc.

Agave. *Agave americana*, L. *American Agave*. *American Aloe*. *Maguey*. (Fam. *Amaryllidaceae*.) — An evergreen succulent plant, indigenous to Florida, Mexico, and other parts of tropical America, and largely cultivated, chiefly for hedges, in the south of Europe, especially in Spain. Although the *Agave americana* is the best known form, botanists have described fifty species of the genus, which are indigenous to South America and the southern portions of North America, and many of which contribute to the economic products produced in that country from the agave plant. The number of these products is very great. *Sisal grass* or *sisal hemp* and *Tampico hemp*, also known as *Pita hemp* or *Pita fiber*, are the most important of the various fibers obtained from the agave leaves, though a number of other forms are locally known in Mexico. From a number of species of *Agave*, are produced in Mexico, large quantities of fermented liquors, known as *pulque*, and distilled liquors known as *mescal* or *tequila*. All of the pulque agaves have thick leaves. When they are about to bloom the central bud is cut out, leaving a large cavity into which the sap (*aguamiel* or *honey water*) exudes, rapidly. At first clear green, yellowish or whitish, this sap soon by fermentation becomes milky and acquires a cider-like taste or, if the process is allowed to go on, is rapidly converted into vinegar. *Pulque* is said to contain about 7 per cent. of alcohol, and is very largely used as a beverage by the Mexicans, but its odor and taste are disagreeable to unaccustomed palates. The juice has in it an optically inactive reducing sugar, agavose, $C_{12}H_{22}O_{11}$. The leaves and roots and stocks of the agave contain saponin and are used in Mexico in the place of soap. The fresh juice is said to be laxative, echicaoutchin, and emmenagogue, and in doses of two fluidounces (60 mils) useful in scurvy. The leaves are said to be used as counter-

Intimately mix 1 Gm. of Aloes with 10 mils of hot water and dilute 1 mil of this mixture with 100 mils of water; a green fluorescence is produced upon the addition of an aqueous solution of sodium borate (1 in 20). Dilute 1 mil of the original aqueous mixture of Aloes with 100 mils of water, and shake it with 10 mils of benzene; upon separating the benzene solution and adding to it 5 mils of ammonia water, a permanent deep rose color is produced in the lower layer. Aloes yields not more than 4 per cent. of ash." *U. S.*

The 1914 British Pharmacopoeia gives the following description: "In hard masses, varying in color from yellowish-brown to dark or chocolate-brown. Fractured surface dull, waxy and uniform (Curacao and Zanzibar aloes), or uneven and somewhat porous (Socotrine aloes). Small splinters examined under the microscope exhibit minute crystals embedded in a transparent mass. Characteristic echicaoutchin; taste nauseous and bitter. The solution obtained by dissolving 0.1 gramme of Aloes in
10 millilitres of boiling *water* and adding 0.5 gramme of *purified borax* acquires a green fluorescence. *Nitric acid* dropped on a little crushed Aloes acquires a reddish-brown color (Socotrine and Zanzibar aloes), or a crimson color (Curacao aloes). Almost entirely soluble in alcohol (60 per cent.). Loss on drying at 100° C. (212° F.) not more than 10 per cent. Ash not more than 5 per cent." *Br.*

Chemical Properties.—Several distinguished chemists have investigated the nature and composition of aloes. Braconnot found a bitter principle, which he named *resino-amer* (resinous bitter), and another substance in smaller proportion, which he designated by the name of *flea-colored principle*. These results were essentially confirmed by Trommsdorff, Bouillon-La-grange, and Vogel. Robiquet obtained a product from aloes which he called *aloetin*. (For details, reader is referred to 14th ed., U. S. Dispensatory.)

ALOINS.—The bitter substances noticed above, viz., the resino-amer of Braconnot, and the *aloetin* of Robiquet, probably contain the active principle of aloes, but combined with impurities which render it insusceptible of crystallization. It has been assumed that there exists not one compound, but a set of three closely related echicaoutchin, to which the general name of aloins is now given. The first of these, found exclusively in Barbados, aloes, and discovered by T. and H. Smith, is called *barbaloin*; the second, discovered by Fliickiger in Natal aloes, is called *nataloin*; the third, found by Histed and Fluckiger in Socotrine

aloes, is called *socaloin*.

The three aloins, *barbaloin*, *nataloin*, and *socaloin*, are easily distinguished by the following reaction, first noticed by Histed. A drop of nitric acid on a porcelain slab gives, with a few particles of barbaloin or nataloin, a vivid crimson (rapidly fading in the case of barbaloin, but permanent with nataloin unless heat be applied), but produces little effect with socaloin. To distinguish barbaloin from nataloin, test each by adding a minute quantity to a drop or two of sulphuric acid, then allowing the vapor from a rod touched with nitric acid to pass over the surface. Barbaloin (and socaloin) will undergo no change, but nataloin will assume a fine blue. (*Pharmacographia*, 2d ed., p. 688.) E. von Sommaruga and Egger consider that the three aloins form a homologous series possessing the formulas: barbaloin, $C_{17}H_{20}O_7$; nataloin, $C_{16}H_{18}O_7$; socaloin, $C_{15}H_{16}O_7$, and that they are all derived from *anthracene*, $C_{14}H_{10}$. Tilden subequently assigned a different composition to the aloins: barbaloin and socaloin, each $C_{16}H_{18}O_7$; for nataloin, the formula $C_{25}H_{28}O_{11}$. He further states that barbaloin and socaloin differ in physical and chemical properties on account of the variation in the molecules of water which are associated with them. Leger assigns to nataloin the formula $C_{23}H_{26}O_{10}$. The British Pharmacopoeia (1898) assigns to barbaloin the formula $C_{16}H_{16}O_7,3H_2O$. Two bases only are recognized now, *barbaloin* (or simply aloin) and *isobarbaloin*. According to Leger (*P. J.*, 1902, 21) *Cape aloes* contains from 5 to 6 per cent. of aloin (barbaloin) without any admixture of the isomeric isobarbaloin. The Barbadoes aloes of English commerce never gave more than 5 per cent. of barbaloin with but minute traces of isobarbaloin, which, however, is always met with in the so-called Barbados aloes of French commerce. *Curacao aloes* is rich in aloin, containing 10 per cent., of which half is echicaoutchin and the other half isobarbaloin. *Jafferabad aloes* is very rich in aloin, yielding 20 per cent., chiefly in the form of isobarbaloin. *Socotrine aloes* does not contain more than 4 per cent. of aloin, almost wholly barbaloin with a very little isobarbaloin. Since barbaloin is found in almost all varieties, the significance of the prefix “barb" is misleading. The only aloes in which it does not occur is that of Natal.

Hugo Borntrager asserted that one part of aloes in 5000 can be detected in the following manner. A little of the suspected liquid is shaken with

about twice its bulk of benzin, which is allowed to separate, decanted, and shaken with a few drops of stronger water of ammonia. On separation the ammonia will be of a clear red color. With solids a tincture should first be made. According to R. H. Groves (*P. J.*, 3d ser., si, 1045), this test will never succeed with a less concentration than 1 part in 250, and with some aloes 1 in 100, and is due to the tannin-like substance of aloes; he also states that extreme care is necessary to have the echicaoutchin solution perfectly clear. (*P. J.*, 1885, p. 633. For Hager's quantitative method for determining the percentage of aloin in aloes, see *A. J. P.*, 1885, p. 237.

R. A. Cripps and T. S. Dymond have given the testing of aloes a lengthy investigation, and they recommend the following method. Place 1 grain of the substance in a glass mortar standing on white paper, now add 16 drops of strong sulphuric acid and triturate until dissolved, then add 4 drops of nitric acid, sp. gr. 1.42, and then 1 ounce of distilled water. If aloes be present, a color varying from deep orange to crimson will be produced, according to the kind of aloes that has been used; the color is deepened by the addition of .ammonia. The table below is taken from the paper of Bainbridge and Morrow. (*P. J.*, Jan., 1890.) Under the heading of Kew Specimens are given the results obtained with juice of aloes plants grown in Kew Gardens.

Commercial Specimens.	HNO_3.	H_2SO_4 and vapor of HNO_3.	Cripps and Dymond test.	C. and D. test with NH_4HO.	Bromine Test.	$FeCl_3$.
Hepatic aloes . .	Reddish-grown.	Nil.	Orange-red.	Intense brownish-red.	Nil.	All varieties of aloes give an olive-green coloration with the above reagent.
True Socotrine .	Reddish-brown.	Nil.	Orange-red.	Intense brownish-red.	Nil.	
Commercial Socotrine . . .	Faint crimson.	Nil.	Crimson.	Deep claret.	Nil.	
Cape	Permanent green after standing a few minutes.	Nil.	Orange-red.	Pale claret.	Nil.	
Curaçao	Evanescent crimson.	Nil.	Crimson.	Intense claret.	Nil.	
Natal	Permanent crimson.	Deep blue.	Deep crimson.	Intense brownish-red.	Nil.	
Barbadoes . . .	Crimson soon fading.	Slight bluish-green occasionally.	Crimson.	Deep claret.	Nil.	
KEW SPECIMENS.						
Aloe ferox. . . .	Evanescent crimson.	Green.	Pale yellow.	Red.	Violet.	
—*socotrina* . . .	Permanent crimson.	Deep blue.	Crimson.	Intense brownish red.	Deep purplish-red.	
—*vera*	Nil.	Slight green.			Nil.	
—*Perryi*	Nil.	Nil.			Nil.	
—*purpurascens* .	Crimson fading to light red.	Nil.			Violet.	
—*platylepis* . . .	Nil.	Nil.			Nil.	
—*arborescens*, var. *frutescens* .	Nil.	Nil.			Nil.	
—*africana* . . .	Evanescent red, changing after a few minutes to green.	Nil.	Orange-red.	Pale claret.	Nil.	
—*chinensis* . . .	Nil.	Nil.			Nil.	

Tschirch, of Berne, has published *(B. P. G.*) 1898, viii, Heft 6) an important communication, in which he showed that *emodin*, $C_{15}H_{10}O_5$, or *trioxymethylanthraquinone*, is the purgative principle otf the aloins. He succeeded in obtaining emodin in orange-red crystals which melt at 216° C. (420.8° F.). Emodin was found in the aloins obtained from Cape, Barbadoes, and Socotrine Aloes; it is extracted by treating echicaoutchin with ether, which dissolves out the emodin. Tschirch found that if a liquid extract of aloes be deprived of its resin and aloin, an additional quantity of emodin could be obtained by boiling the liquid extract with diluted sulphuric acid, thus pointing to the fact that emodin may be produced through hydrolysis. He also showed that emodin could be obtained from purgative drugs of the same class as aloes: rhubarb, rumes, frangula, cas-cara, senna, rhamnus catharticus, morinda bark, and parmelia.

Aloes yields its active matter to cold water, and when good is almost wholly dissolved by boiling water; but the inert portion, or apotheme of Berzelius, is deposited as the solution cools. It is also soluble in alcohol, rectified or diluted. Long boiling impairs its purgative properties by oxidizing the aloin and rendering it insoluble. The alkalies, their carbonates, and soap alter in some measure its chemical nature, and render it of easier solution. It is inflammable, swelling up and decrepitating when it burns, and giving out a thick smoke which has the odor of the drug.

Those substances only are incompatible with aloes which alter or precipitate the soluble matter, as the insoluble portion is without action upon the system. Among these is the infusion of galls, which we have found, probably through its tannic acid, to afford a copious precipitate with an aqueous solution of aloes. It is said that such a mixture will keep a long time, even for a period of several months, without moldiness or putrescence, though it becomes ropy.

A method for the detection of aloes in mixtures containing other cathartic drugs, such as rhubarb, caseara, etc., has been described by Mossley (*Chem. and Drug.*, 1913, 915). The method depends upon the precipitation of the oxymethyl anthraquinones, which usually interfere in such identification tests, and the subsequent detection of aloes by the addition of bromine T.S., which precipitates aloin, and the green fluorescence produced with aloes by borax.

Uses.—Aloes was known to the ancients, being cultivated in the island of Socotra as far back as the time of Alexander the Great, and is mentioned in the works of Dioscorides and of Celsus. Its cathartic action is due to a stimulation of peristalsis, especially in the larger bowel, probably the result of a local irritant effect upon the mucous membrane, although there is some evidence that it exercises a specific stimulant effect upon unstriped muscles. As its action is largely limited to the colon it is not to be recommended in those conditions in which it is desirable to clean out the whole alimentary canal, and as its effect is largely the result of local irritation it should be avoided in inflammatory conditions of the intestines. In chronic constipation, however, especially when dependent upon an atonic condition of the lower bowel, it is one of the most useful laxatives that wa possess. Many believe that it possesses a directs tonic action, not only evacuating the bowel of its contents but encouraging a restoration toward normal conditions. The presence of bile in the bowel seems in some way to be essential for the best effects of this drug, and in those cases in which this secretion is lacking it is well to exhibit some preparation of bile in conjunction with the aloes. Soap also appears to enhance the cathartic action of this drug. It was formerly almost universally believed that aloes possessed emmenagogue properties and it was accordingly largely used in the treatment of various forms of *amenorrhea.* It is, however, extremely doubtful whether it exercises any action upon the pelvic echicaoutchin which is not
attributable to its cathartic effects.

Crude aloes is rarely used in human medicine, but may be given in *doses* of from two to ten grains (0.13-0.65 Gm.).

Off. Prep.—Extractum Colocynthidis Com-positum, U. S. ().); Pilulae Aloes, U. S. (*Br.*); Pilulas Rhei Composites, *U. S.* (*Br.*); Tinctura Aloes, *U. S.*; Tinctura Benzoini Composita, *U. S. (Br.)*', Decoctum Aloes Compositum, *Br.*; Extractum Aloes, *Br.*; Pilula Aloes et Asafetidae, *Br.*; Pilula Aloes et Ferri, *Br.*; Pilula Aloes et Myrrhae, *Br.*; Pilula Colocynthidis Composita, *Br. (N. F.)*; Extractum Aloes, *N. F.*; Pilulae ad Prandium, *N. F.*; Pilulae Aloes et Asafoetidae, *N. F.*; Pilulae Aloes et Ferri, *N. F.*; Pilulae Aloes et Mastiches, *N. F.*; Pilules Aloes et Myrrhae, *N. F.*; Pilulae Aloes et Podophylli Compositae, *N. F.*; Pilulae Aloes, Hydrargyri et Scammonii Compositas, *N. F.*; Pilulae Antiperiodicas (from Extract), *N. F.*; Pilulae Colocynthidis et Hyoscyami, *N. F.*; Pilulae Ferri, Quininae, Aloes et Nucis Vomicae, *N. F.*; Pilulae Laxativae Post Partum, *N. F.;* Pulvis Aloes et Canellae, *N. F.*; Tinctura Aloes et

Myrrhae, *N. F.*; Tinctura Antiperiodica (from Extract), *N. F.*; Tinctura Zedoariae Amara, *N. F.*

ALSTONIA. Br. ALSTONIA

"Alstonia is the dried bark of *Alstonia scholaris*, E. Br., and also of *Alstonia constricta*, F. Muell." *Br.*

Dita Bark; Australian Fever Bark; Bitter Bark.

Under Alstonia the British Pharmacopoeia recognizes the dried barks of *Alstonia scholaris* (L.) R. Br. (*Echites scholaris* L.), of India and the Philippine Islands, and *Alstonia constricta* F. Muell., of Australia, two apocynaceous trees whose barks are quite dissimilar in appearance, and, as far as our present knowledge goes, contain different alkaloids. These barks are respectively described as follows:

"Bark of Alstonia scholaris usually in irregular fragments, three to twelve millimetres thick; texture somewhat spongy, fracture short and coarse; external layer unevenly rough and fissured, brownish-grey with occasional blackish spots; internal layer bright buff. Transverse section shows numerous small medullary rays in inner layer. Almost odorless; taste echicaoutchin. Bark of Alstonia constricta usually in curved pieces or quills about sixty millimetres wide, and twelve millimetres thick. Periderm from two and a half to six millimetres thick, rusty brown, strongly rugose, with large deeply fis-sured reticulations. Bark internally cinnamon-brown, with strong, coarse longitudinal striae. Transverse section shows dark-brown periderm covering the inner orange-brown tissues, in which numerous small shining particles can be seen with a lens. Fracture short and granular in outer layers, fibrous in inner. Slight aromatic odor; taste very bitter." *Br.*

From the bark of *Alstonia scholaris* M. Gruppe extracted an uncrystallizable, hygroscopic, bitter principle, *ditaine*. (*J. P. C.*, 4e ser., xviii, 225; xix, 84; *P. J.*, Aug., 1875.) Harnaek (*Ber. d. Chem. Ges.*, 1878) first obtained ditaine in pure crystallized form, and gave it the formula $C_{20}H_{30}N_2O_4$. O. Hesse (*P. J.*, Oct. 23, 1880) finds in dita the following principles: three alkaloids: *ditamine*, $O_{16}H_9O_2N$, the relative amount of which he estimates at 0.04 per cent.; *echitamine*, $C_{22}H_{28}O_4N_2$ + H_20 (identical, according to Hesse, with Harnack's ditaine); and

echitenine, $C_{20}H_{27}O_4N$. Of these, the second is the strongest base, and resembles ammonia in its chemical characters; Hesse considers it with one molecule of water to form the hydroxide of a strong basic radical, *echitammonium*, $C_{22}H_{29}O_4N_2$. The solutions of *echitammonium hydroxide* are so strongly basic that they precipitate the hydroxides of copper, iron, aluminum, and lead, and decompose sodium and potassium chlorides, liberating the corresponding echicaoutchin. Hesse considers echitammonium the most strongly basic of all the alkaloids. Hesse also obtained by extraction with petroleum benzin *echicaoutchin*, *echiretin*, *echicerin*, *echitin*, and *echitein*, of which the three last mentioned are crystalline.

From *Alstonia constricta*, F. V. Miiller and A. Rummel obtained *alstonine*. Oberlin and Schlagdenhauffen found in 1879 another alkaloid, alstonicine. Hesse subsequently analyzed the bark and found alstonine, the *chlorogenine* of a former investigation, which has the composition $C_{21}H_{20}O_4N_2$, *prophyrine*, $C_{21}H_{25}O_2N_3$, and *alstonidine*. The alkaloids and their salts in acidulated solutions show decided blue fluorescence.

Uses.—This drug has been used for many years in Australia and the Philippine Islands in the treatment of malarial and other fevers, as well as a simple bitter. The alkaloid ditaine has been scientifically studied by Harnach (*A. E. P. P.*, 1877, xvii, p. 126), who finds that it has a paralyzing effect upon the endings of the motor nerve similar to that produced by curara. In large dose it also paralyzes the cardio-inhibitory nerves and lowers blood pressure. There is nothing in this study, which is, as far as we know, the only scientific investigation of the drug which has been made, to explain any action in echicaoutchin. Nevertheless some of
the clinical reports, especially from the eclectic physicians, have been extremely laudatory, vaunting it even as a substitute for quinine.

Dose, two to four grains (0.13-0.25 Gm.).
Off. Prep.—Infusum Alstonia;, *Br.*; Tinctura Alstoniffi, *Br.*

ALTHAEA. U. S. ALTHAEA [Marshmallow root]

" The root of *Althaea officinalis* Linne (Fam. *Malvaceae*) deprived of the brown, corky layer and small roots, and carefully dried. Preserve Althaea in tightly-closed containers, adding a few drops of chloroform or