

difficulty from Strychnine, in many samples of which it occurs as an impurity. It is seldom used. Dose, gr. $\frac{1}{10}$ – $\frac{1}{4}$.

Incompatibles.

Incompatible with *Nux Vomica* and *Strychnine* are Alkalies and their Carbonates, Bromides, Iodides, Chlorides, and all other alkaloidal precipitants (see page 5). Oils and fats retard the absorption of strychnine salts. Physiologically incompatible are Aconite, Alcohol, Amyl Nitrite, Atropine, Chloral Hydrate, Chloroform, Curarine, Digitalis, Hydrocyanic Acid, Morphine, Nicotine, Paraldehyde, Physostigmine, Potassium Bromide, Urethane.

Tests for Strychnine and Brucine.

Strychnine and its salts dissolve without color in concentrated Sulphuric Acid, but, on adding to the solution some deoxidizing substance, a play of colors results, *Lead Peroxide* producing a beautiful blue, passing into violet, then red, and finally yellow (Marchand). A minute quantity of *Potassium Dichromate* produces similar results (Otto), while *Cerose-ceric Oxide* causes a blue, changing to violet and then to a permanent cherry-red. If these tests are carefully applied, as minute a quantity as 1 part in 900,000 of the solution may be detected (Wenzell). A similar blue-violet reaction is produced when a mixture of Hydrastine 1 and Morphine 9 is acted on by Sulphuric Acid and Potassium Dichromate, or by Sulphuric Acid alone (Lloyd); but the occurrence of the reaction with the acid alone serves to distinguish the mixed alkaloids from Strychnine, which dissolves in sulphuric acid without producing any color.

Brucine is detected by the red color which it yields with *Nitric Acid*. Neither Nitric nor Sulphuric Acid colors Strychnine unless Brucine is present as an impurity, a test which distinguishes this alkaloid from several others. Brucine does not decompose *Iodic Acid*, and is thereby distinguished from Morphine.

PHYSIOLOGICAL ACTION.

The action of *Nux Vomica* is that of its principal alkaloid Strychnine. Externally, the latter is a very powerful antiseptic, but is too poisonous for safe use, and in concentrated solution hypodermically it has a decided irritant action on the tissues. Internally in small doses its bitter quality makes it a good stomachic tonic. Increasing the vascularity of the gastric mucous membrane and promoting the secretion of gastric juice, also the pancreatic and biliary secretions, it aids digestion and sharpens the appetite, but like all other bitter tonics it deranges digestion when used excessively or for a long time. It stimulates the muscular coat of the intestines increasing peristalsis and thus acts as a purgative, but it restrains the fecal discharges when their frequency is due to atony of the bowel. It stimulates the motor nerve-cells of the spinal cord, the cardiac motor ganglia, the respiratory and vaso-motor centres in the medulla, contracting the arterioles all over the body (though by full doses they are relaxed), also the excitability of the sensory nerves and their terminal elements. The result is that respiration is deepened and quickened, the action of the heart is increased and the blood-pressure raised, the field of vision is enlarged, the sight and hearing are sharpened, and the sense of touch is rendered more acute, but the cerebral convulsions are not affected. Excreted chiefly by the kidneys, it causes increased frequency of urination, and when taken in excess produces spasm of the neck of the bladder. It probably excites some degree of uterine contraction, but undoubtedly promotes menstruation, disposes to sexuality, and provokes erections of the penis.

The most marked feature of the action of Strychnine is the great increase which it causes in the reflex excitability of the spinal cord and other reflex cen-

tres, such as the vaso-motor and respiratory centres in the medulla. When the dose is large this increase is so great as to induce convulsions and cause death by asphyxia. After a large dose (gr. $\frac{1}{12}$) the pupils dilate, the limbs take on jerking movements, respiration becomes spasmodic and the lower jaw stiff, a sensation of cerebral tension may be felt, and sudden shuddering and anxiety follow, the face taking on an unmeaning smile, the *risus sardonicus*. A toxic dose (gr. $\frac{1}{2}$ to gr. ij) produces powerful and characteristic convulsions of a tetanic character. Within an hour after its administration, sometimes after only a few minutes, the patient feels a sudden sense of suffocation and dyspnea, the muscles begin to shudder and jerk, the limbs are suddenly stretched out rigidly, with hands clenched and feet arched, then the head is bent backward and the whole body becomes stiffly arched resting on the head and the heels, the belly tense, the chest muscles fixed and the breathing all but arrested. In the height of the paroxysm the face is dusky and congested and the eyeballs project. Nearly all the muscles of the body are affected, but those of the jaw are not seriously implicated until near the end, and never so powerfully as in tetanus. The pulse is very rapid and the body-temperature is above normal, but the intellect remains unclouded and the patient often expresses a sense of impending dissolution. After the paroxysm has lasted a minute or two it usually relaxes for a time. In the interval the patient suffers from soreness of the muscles, feels exhausted and sweats profusely, but soon becomes aware that the spasm is returning and may cry out for some one to hold him or to rub his limbs. The convulsions rapidly increase in severity, a breath of wind, the slightest noise, even a bright light, being sufficient to bring them on, and in one the patient may jerk himself out of the bed. At last the respiration stops in the middle of a fit and the heart soon ceases to beat. Death occurs, after two or three hours at most, by asphyxia from tetanic fixation of the muscles of respiration, with possible factors in spasm or exhaustion of the heart, consciousness being preserved until carbon dioxide narcosis sets in.

Strychnine exalts all the functions of the spinal cord, reflex, motor, vaso-motor, and sensory, the latter being the least affected. It has selective action on the large multipolar ganglia in the anterior columns, which it first stimulates and finally paralyzes by over-stimulation, in this respect illustrating the rule that small and large doses of an active agent act antagonistically to each other. A massive dose seems to destroy the spinal and medullary functions as by a single blow. The spasms of Strychnine may be distinguished from those of tetanus by their intermittency (the latter being constant), by the meaningless smile, the less marked trismus, the absence of a wound, and the rapid course of the symptoms. Thebaine, the tetanizing alkaloid of opium, is also a spinal exaltant, and acts much the same as strychnine.

Strychnine does not directly affect the muscular tissue, the motor nerve-trunks or nerve-endings, or the cerebral convulsions. Occasionally, however, large medicinal doses cause a greatly heightened sensibility of the optic

and auditory nerves, so that brilliant lights and loud sounds produce painful impressions; and in a few cases there occurs a true cerebral intoxication resembling a slight degree of drunkenness. It probably affects all the nervous centres in some degree, the sensory, however, much less than the motor and vaso-motor ones. It is to some extent oxidized and destroyed in the body, the remainder being eliminated by the urinary, salivary and cutaneous channels. As it contracts the renal arteries, it hinders its own excretion by the kidneys, and being rapidly absorbed it may accumulate in the system if even a small dose is frequently and continuously administered. It is much more poisonous when injected into the rectum than when swallowed.

The fatal dose of Strychnine is placed by Taylor at gr. $\frac{1}{2}$ to gr. ij for an adult, but recovery has taken place after larger doses, even 7 and 8 grains, cases probably of imperfect absorption, due perhaps to the presence of fat or tannin in the contents of the stomach. A child, aged 2 $\frac{1}{2}$ years, died in four hours from a dose of gr. $\frac{1}{16}$. After death from this poison cadaveric rigidity is marked, with opisthotonos, clenched hands, and arms flexed across the chest. The muscular rigidity may persist for several months after death. The face is usually pale, but sometimes livid, the internal organs are gorged with dark blood, and the bladder is generally contracted.

On other animals Strychnine acts as it does upon man, but in different degrees. Birds, guinea-pigs and perhaps monkeys, are comparatively insusceptible to it, while ruminants are less easily affected than other quadrupeds, and cats resist it singularly. Very minute portions in the soil will destroy the life of growing plants.

THERAPEUTICS.

Nux Vomica and its chief alkaloid, Strychnine, are exceedingly useful remedies, having a wide range of therapeutic efficacy. They are chiefly employed as stomachic tonics, and as stimulants to the heart, the respiratory apparatus, and the muscular and nervous systems. As the quantity of strychnine in nux vomica varies greatly, it is best to use the alkaloid when its physiological action is desired, more definite dosage being thus obtained. The tincture in 5-drop doses is excellent in atonic dyspepsia and gastric catarrh, especially in drunkards, and in constipation from atony of the bowels it may be given in 10-drop doses with good results, not as a purgative but to increase peristalsis. The extract is much used in laxative pills for habitual constipation. In the vomiting of pregnancy the tincture is frequently an efficient remedy, and in the vomiting of phthisis Strychnine is one of the very best agents. In the condition clinically known as that of torpid liver, where the stools are of pale color and very offensive odor, showing absence of bile therein, the tongue coated with a thick, perhaps yellowish fur, and the patient complaining of headache, lassitude, anorexia, and a bad taste in the mouth, small doses of Strychnine (gr. $\frac{1}{60}$) twice or thrice daily will frequently act as well as a mercurial, restoring the bile to the stools, and correcting the other symptoms.

Epidemic diarrhea and dysentery are often controlled by Strychnine, and in anemia and chlorosis it is an invaluable remedy, especially when combined with iron and quinine. In intermittents, as an adjunct to quinine it is always useful, and in neuralgia, especially of the viscera, and infraorbital and other forms accompanying anemia and general debility, it is highly efficient, but in these affections very small doses (gr. $\frac{1}{100}$) should be employed.

Headaches are often controlled by Nux Vomica, especially the sick headache of gastric origin, in which minim-doses of the tincture every ten or fifteen minutes frequently give marked relief, and a dose of $\mathfrak{m}x$ before each meal will prevent frontal headache in many persons liable thereto. A sense of heat and weight on top of the head, accompanied or not by flatulence, and usually occurring in women at the climacteric, will often yield to the tincture in doses of $\mathfrak{m}v$ before each meal. Its undoubted influence on the pneumogastric makes it a valuable remedy for many kinds of cough, even those of phthisis, bronchitis, pneumonia and emphysema, but it is particularly efficient in coughs of neurotic origin, such as periodical cough, night cough, and the paroxysmal laryngeal cough without lung or bronchial symptoms, but characterized by a persistent tickling sensation in the throat. In all these drop-doses of the tincture frequently repeated are more serviceable than larger doses at longer intervals. In bronchial asthma and asthma of neurotic origin, in the dyspnea of pulmonary affections and that with cardiac palpitation in hysterical subjects, in irregular action and over-action of the heart, in functional anesthesia, hypochondriasis, abdominal cramps, nervous movements accompanying pregnancy, cold hands and feet due to languid capillary circulation, prolapsus ani and urinary incontinence in children, and paralysis of the bladder in old people, small doses of Strychnine frequently repeated are remarkably beneficial. In many of these affections the therapeutic action of the drug is unmistakably that of an antispasmodic, illustrating the opposite effects of large and small doses of an active agent, a thoroughly established fact in many cases, though not a universal rule.

Nux Vomica is a most efficient remedy in impending cardiac failure from almost any cause. Even with the pulse imperceptible, the extremities cold, and death apparently imminent, the administration of a drop of the tincture every five minutes has frequently given renewed strength to the cardiac contractions after five or six doses, and initiated an improvement which resulted in eventual recovery. Local paralyzes of various forms are well treated by the hypodermic injection of Strychnine into the substance of the affected muscles, and diphtheritic paralyzes are almost invariably cured by its internal administration. It may prove useful in hemiplegia when degeneration has not set in, and when the paralyzed muscles are completely relaxed; but it is of no avail in recent cases or when electrical contractility is lost. If used early in cerebral paralyzes, especially when due to hemorrhage, it may do serious harm; and in the early stage of organic spinal lesions it may be de-

cidedly injurious, particularly if given in large doses. It should never be used in spinal paralysis when there are symptoms of congestion or inflammation of either the cord or its membranes. In hysterical paralysis and that caused by lead it is decidedly beneficial, also in the form which is limited to one or two groups of muscles, especially infantile paralysis of long standing, even when the atrophic process has gone so far as to greatly impair the electrical sensibility. In multiple peripheral neuritis the hypodermic injection of strychnine has proved eminently serviceable.

Strychnine is very useful in cases of nervous impairment of the sight, especially in amblyopia from lead, tobacco or alcohol, from atrophy of the optic nerve, and from functional disorders of the retina without apparent lesion, also in muscular asthenopia. In these affections it may be used internally, but it is usually administered by injection into the tissues around the temple, beginning with gr. $\frac{1}{40}$, and gradually increasing the dose up to gr. $\frac{1}{8}$ or $\frac{1}{6}$. Improvement may not be apparent until the larger doses are reached.

In acute and chronic alcoholism, Strychnine is undoubtedly of great service. In small doses it is an effective remedy for the morning vomiting and dyspepsia of drunkards, for the tremor of chronic dipsomaniacs, in the forming stage of delirium tremens, and for the depression due to enforced abstinence from alcohol. The nitrate, in doses of gr. $\frac{1}{30}$ to $\frac{1}{20}$, hypodermically three or four times daily for a week, and less frequently for two weeks longer, removes the craving for stimulants, counteracts the vaso-motor paralysis to which most of the injurious effects of alcohol are due, and is probably in other respects a true antagonist to the action of that narcotic poison on the human organism. The published reports of its efficacy in dipsomania, by Luton, Dujardin-Beaumetz, Portugaloff and others, have been fully confirmed by other observers, so that Strychnine is now the acknowledged remedy for inebriety, and the efficient constituent of the numerous "cures" therefor so widely advertised in the religious and secular press.

Strychnine is a physiological antagonist to chloral, physostigmine and morphine, and may be used as a respiratory stimulant in poisoning by these drugs, also in narcotic poisoning by any agent when the respiration is failing. It has been employed in Australia as an antagonist to serpent venom with great success in the hands of Mueller and others, and with doubtful efficacy in the experience of many observers. From the results of experiments made by Dr. Elliot, of the Indian army, it would seem that its use in poisoning by cobra venom, is of no service whatever and may actually hasten death.

Strychnine Arsenite possesses strong antiperiodic power, and may prove an efficient remedy for any intermittent disease which proves rebellious to the influence of quinine. As it is a highly toxic agent, the minimum dose (gr. $\frac{1}{100}$) should not be exceeded at its first administration, and its effects should be watched after repetition of the dose.

Brucine acts precisely as strychnine, except that it is absorbed more slowly, is much less powerful as a convulsant, and is more poisonous to the sensory nerves (Reichert). If pure it is a powerful local anesthetic in 5 to 10 per cent. solutions on mucous membranes, and in a 20 per cent. solution on the skin. In the latter strength its solutions have been employed with satisfaction for chronic pruritus, and in a weaker solution (5 per cent.) for the local pruritus of inflammation about the external ear, in which Dr. Burnett claims for it more satisfactory results than are obtained with cocaine.

OLIVÆ OLEUM, Olive Oil, (Sweet Oil, Salad Oil),—is a fixed oil expressed from the ripe fruit of *Olea europæa*, the olive tree, nat. ord. Oleaceæ, which is cultivated in southern Europe, California and Australia. It is a pale-yellow or greenish-yellow oily liquid, of nutty, oleaginous taste and neutral reaction, sparingly soluble in alcohol but readily soluble in ether. Dose, ℥ss-jss [av. ℥j.]

Olive Oil consists in the main of the combined glycerides of oleic, palmitic and arachic acids. It is frequently adulterated with cheaper fixed oils, especially poppy oil, lard oil, and cotton-seed oil, quantities of the latter being exported every year to Italy, whence it is returned to us as Olive Oil under a French label. (See *Gossypium*.) It is an ingredient of Unguentum Diachylon, and is the source of the official Soap.

PHYSIOLOGICAL ACTION AND THERAPEUTICS.

Externally used Olive Oil is a good protective from the air, and renders the skin soft and flexible. If rubbed into the integument it is absorbed by the lymphatics and is directly nutritive in effect. Internally it is nutritive and mildly laxative, and in quantity acts as a protective to the mucous membrane against acrid or poisonous substances. Like other oils it is partly emulsified, partly saponified in the intestines, its glycerin being set free and its fatty acids combining with the free alkalis to form soap, which with the emulsion forms the molecular basis of the chyle, entering the blood through the lacteals and being finally oxidized into carbon dioxide and water, though an excess will appear unchanged in the urine. Oils are therefore a food within certain limits, increase the fat of the tissues, furnish heat and force, and lessen the waste of nitrogenous tissue, but are unable of themselves to support life.

Olive Oil possesses some very marked therapeutic powers over any other bland oil or fat. It is a good laxative for infants administered internally, and may be used as an enema followed by warm water. There is much clinical evidence to prove that administered internally it is a very efficient remedy in both nephritic and biliary colic, due to its setting free glycerin, which being absorbed reaches the liver and stimulates the production of a watery bile, which is solvent to the cholesterin of gall-stones. In large doses it has proved very efficient in the treatment of severe dysentery. It is much employed locally. Applied to burns and other acute inflammatory affections of the skin it is an excellent protective, coating the surface and excluding

the air; and as an ingredient of liniments it acts as a diluent for more active agents. It is used to facilitate friction over enlarged or stiff joints, and in the desquamative stage of scarlet fever is a very useful and grateful application. As an antidote in corrosive poisoning it acts mechanically by protecting the mucous membrane of the stomach and preventing absorption. In pharmacy its bland, unirritating qualities have procured its common employment as an ingredient of liniments, plasters, ointments and cerates, but the foreign article is so frequently adulterated with inferior oils that Cottonseed Oil is now directed in its place in many official preparations

OPIUM,—is the concrete, milky exudation, obtained by incising the unripe capsules of the White Poppy, *Papaver somniferum*, an annual herb of the nat. ord. Papaveraceæ, indigenous to Western Asia, but cultivated extensively elsewhere. Its capsules are globular, two or three inches in diameter, and are crowned by a sessile, stellate stigma, which distinguishes them from Colocynth and Bael fruits. Opium occurs in irregular lumps or cakes, of dark-brown color, sharp, narcotic odor, and bitter taste; and in its normal, moist condition should yield not less than 9 per cent. of Morphine when assayed by the official process. Dose, gr. ss–ij [av. gr. jss.]

Opium contains 20 alkaloids in combination with meconic, lactic and sulphuric acids; the neutral principles *Meconin* and *Meconiasin*; also glucose, mucilage, resin, pectin, caoutchouc, fats, essential oil, odorous substances, salts of ammonium, magnesium and calcium, and water. Its principal alkaloids are the following six, viz.—

Morphine, $C_{17}H_{19}NO_3$, 2½ to 20 per cent.,—the principal alkaloid, occurring in the drug in the form of the tribasic meconate. Its properties are anodyne, hypnotic and narcotic. From it by a process of dehydration by heat and hydrochloric acid is prepared the artificial alkaloid *Apomorphine*, a powerful emetic and expectorant.

Codeine, $C_{18}H_{21}NO_3$, 0.3 to 0.5 per cent.,—is calmative and when pure a not very active alkaloid, but is frequently contaminated with other alkaloids. *Apomorphine* may be prepared from it.

Narceine, $C_{22}H_{29}NO_8$, 0.2 to 0.7 per cent.,—was said by Bernard to be a powerful narcotic, but the preparation used by him was probably impure, and it is now believed to have little or no action.

Narcotine, $C_{22}H_{23}NO_7$, 2 to 10 per cent.,—is antiperiodic and a tetanizer, but wholly devoid of narcotic properties.

Thebaine, or *Paramorphine*, $C_{16}H_{21}NO_3$, 0.2 to 1 per cent.,—is a powerful spinal exaltant and tetanizer, resembling Strychnine in its action.

Papaverine, $C_{20}H_{21}NO_4$, 1 per cent.,—stands midway between morphine and codeine in its action on the central nervous system, but is a comparatively weak poison.

Other Alkaloids are—Codamine, Cryptopine, Gnoscopine, Hydrocotarnine, Lanthopine, Laudanine, Laudanosine, Meconidine, Oxynarcotine, Papaveramine, Protopine, Pseudomorphine, Rhœadine, and Tritopine. Many of them occur only in traces, and some are regarded as probable derivatives of morphine. *Porphyroxin* is said to be a complex combination of several of the alkaloids, and not a proximate principle.

Official Preparations of Opium.

Opii Pulvis, *Powdered Opium*,—is Opium dried at a temperature not exceeding 185° F., and reduced to a very fine powder. It should contain not less than 12 nor more than 12½ per cent. of crystallized Morphine, when assayed by the official process. Dose, gr. ss–ij [av. gr. j.]

Opium Granulatum, *Granulated Opium*,—is Opium dried and reduced to a coarse powder. It should yield from 12 to 12½ per cent. of Morphine. Dose, gr. ss–ij [av. gr. j.]

Opium Deodoratum, *Deodorized Opium*, (*Denarcotized Opium*)—is powdered Opium freed from the constituents which are soluble in Petroleum Benzin, namely, Narcotine and the odorous principles, which are supposed to cause the unpleasant after-effects of the drug. It should yield 12 to 12½ per cent. of Morphine, and is a good preparation, being a purified opium with a fixed morphine standard. The proprietary article named *Svapnia* is a similar preparation. Dose, gr. ss–ij [av. gr. j.]

Extractum Opii, *Extract of Opium*,—an aqueous extract containing 20 per cent. of Morphine, and freed from principles insoluble in water. Dose, gr. ¼–ij [av. gr. ss.]

Pilulæ Opii, *Pills of Opium*,—each pill contains about gr. j of powdered Opium incorporated with Soap. Dose, j–ij pills [av. j.]

Tinctura Opii, *Tincture of Opium*, *Laudanum*,—Opium-strength 10 per cent. or 48 grains to the fl ʒ. Morphine-strength about 6 grains (equal to 7½ grains of morphine sulphate) to the fl ʒ. Ten minims equal 1 grain of Opium or ⅓ grain of Morphine. Sixty minims equal on the average about 120 drops. Dose, ʒv–xxx [av. ʒviiij], according to the effect desired.

Tinctura Opii Deodorati, *Tincture of Deodorized Opium*,—an aqueous extract is prepared and shaken with Benzin, which being separated the residue is dissolved in water, and enough alcohol is added to preserve it. An excellent liquid preparation, being freed from all the noxious and useless ingredients soluble in alcohol and ether. Opium-strength 10 per cent., average Morphine-strength gr. vj to the fl ʒ. Dose, as of Tinctura Opii. Drops of this preparation nearly equal minims. *McMunn's Elixir* is a similar preparation, so also is another proprietary nostrum named *Papine*.

Vinum Opii, *Wine of Opium*, (*Sydenham's Laudanum*),—Opium-strength 10 per cent., with the aromatics Cinnamon and Cloves of each 1 per cent., in Alcohol and White Wine. A vinous tincture decreased somewhat in strength from the wine of 1870. Dose, as of Tinctura Opii. Drops of this preparation are larger than those of the tincture.

Acetum Opii, *Vinegar of Opium*, (*Black Drop*)—Opium-strength 10 per cent., with Nutmeg and Sugar in Dilute Acetic Acid. Is now ⅓ weaker than formerly, having the same strength and dose as Tinctura Opii.

Tinctura Opii Camphorata, *Camphorated Tincture of Opium*, *Paregoric*,—has of Powdered Opium 4, Benzoic Acid 4, Camphor 4, Oil of Anise 4, Glycerin 40, Diluted Alcohol to 1000. ʒss contains nearly one grain of powdered Opium. It is about ⅓ of the strength of Laudanum. Dose, for an infant gtt. v–xx, for an adult ʒj–iv [av. ʒij.] Is an ingredient of Mistura Glycyrrhizæ Composita.

Emplastrum Opii, *Opium Plaster*,—contains of Extract of Opium 6 parts, Adhesive Plaster to 100.

Pulvis Ipecacuanhæ et Opii, *Powder of Ipecac and Opium*, (*Dover's Powder*)—has of Ipecac 10, Powdered Opium 10, Sugar of Milk 80, rubbed together into a very fine powder. Dose, gr. v–xv [av. gr. vijss].

Tinctura Ipecacuanhæ et Opii, *Tincture of Ipecac and Opium*,—has of Tincture of Deodorized Opium 100 evaporated to 80, Fluidextract of Ipecac 10, Diluted Alcohol to 100. Is intended to represent Dover's Powder in liquid form. Dose, ʒv–xv [av. ʒviiij.]

Trochisci Glycyrrhizæ et Opii, *Troches of Glycyrrhiza and Opium*—each troche contains of powdered Opium gr. ⅓, with Extract of Glycyrrhiza, Acacia, Sugar and Oil of Anise. Dose, j–iv troches.

Official Preparations of Morphine.

Morphina, *Morphine*, $C_{17}H_{19}NO_3 + H_2O$,—white, prismatic crystals, or fine needles, or a crystalline powder, odorless, of bitter taste and alkaline reaction, almost insoluble in water. Its comparative insolubility makes the salts preferable for use, and as a very small proportion of acid neutralizes it, the dosage is about the same for the alkaloid and its salts, viz., gr. ⅓–½ [av. gr. ⅓.]

Morphinæ Acetas, *Morphine Acetate*,—a white, crystalline or amorphous powder of faintly acetous odor, bitter taste, neutral or faintly alkaline reaction, soluble when fresh in 2½ of water at 59° F. Dose, gr. ⅓–½ [av. gr. ¼.]

Morphinæ Hydrochloridum, *Morphine Hydrochloride*,—white, feathery crystals of silky lustre, of bitter taste and neutral reaction, soluble in 24 of water and in 62 of alcohol at 59° F. Dose, gr. ⅓–½ [av. gr. ¼.]

Morphinæ Sulphas, *Morphine Sulphate*,—white, feathery, acicular crystals of silky lustre, of bitter taste and neutral reaction, soluble in 21 of water and in 702 of alcohol at 59° F., and in 0.75 of boiling water. Contains about 80 per cent. of morphine. Dose, gr.

$\frac{1}{2}$ – $\frac{1}{4}$ [av. gr. $\frac{1}{4}$]; gr. $\frac{1}{2}$ is a small dose for an adult, gr. $\frac{1}{4}$ a moderate one, gr. $\frac{1}{2}$ a full dose, and gr. $\frac{1}{2}$ a large dose, admissible only under exceptional circumstances.

Pulvis Morphinae Compositus, *Compound Powder of Morphine*, (Tully's Powder)—has of Morphine Sulphate 1½ part to Camphor 32, Licorice 33 and Calcium Carbonate 33½. A similar preparation to Dover's powder minus the Ipecac. Dose, gr. v–xv [av. gr. vijss] ten grains containing gr. $\frac{1}{2}$ of Morphine Sulphate.

Injectio Morphinae Hypodermica, *Hypodermic Injection of Morphine* (B. P.),—is a solution of the Tartrate, containing gr. j in ℞xxij. Dose, by hypodermic injection, ℞ij–v.

Tinctura Chloroformi et Morphinae Composita, *Compound Tincture of Chloroform and Morphine* (B. P.),—a substitute for Chlorodyne (see page 220). Dose, ℞v–xx.

Unofficial Preparations of Opium and Morphine.

Tinctura Opii Composita, *Compound Tincture of Opium, Squibb's Diarrhea Mixture*,—has of Tinct. Opii, Spt. Camphoræ and Tinct. Capsici ̄j of each, Purified Chloroform ̄iij, Stronger Alcohol q. s. ad ̄v. Each fl̄j or teaspoonful contains about 100 drops or ℞xij of each of the first three ingredients and ℞ivss or 18 drops of Chloroform. Dose, for infants gtt. j–x, for children gtt. x–xxx, for adults ̄ss–j.

Liquor Morphinae Sulphatis, *Solution of Morphine Sulphate, Magendie's Solution*,—has gr. xvj of Morphine Sulphate in each fl̄j, or gr. j in ℞xxx, or gr. $\frac{1}{4}$ in ℞vijss. If containing Benzoic Acid, the solution will not spoil, and is not irritant hypodermically. The same result is attained by adding Phenol, ℞ij to the ̄j.

Oleatum Morphinae, *Oleate of Morphine*,—Morphine-strength 10 per cent. with Oleic Acid 90. For local use.

Liquor Opii Sedativus, *Sedative Solution of Opium, Battle's Sedative*,—is about 50 per cent. stronger than Tinct. Opii. It was formerly a favorite preparation.

Dalby's Carminative,—contains Opium, about gr. $\frac{1}{2}$ to the ounce, also Oil of Pepper mint, Nutmeg, Anise, and Magnesium Carbonate.

Godfrey's Cordial,—contains Laudanum, Sassafras and Treacle, its opium strength being gr. $\frac{1}{2}$ to the ounce.

Nepenthe,—is a purified alcoholic solution of Morphine Meconate in sherry wine.

Chlorodyne,—(see page 220). contains Morphine in varying proportions, that of J. Collis Browne having gr. vj to the ounce.

Mrs. Winslow's Soothing Syrup,—contains Morphine, with Essence of Anise and Syrup of Tolu. After years of persistent denial, its proprietors have admitted that it contains $\frac{1}{2}$ grain of Morphine in each fluidounce (Squibb).

Derivatives of Morphine.

Apomorphinae Hydrochloridum, *Apomorphine Hydrochloride*, $C_{17}H_{17}NO_2HCl$,—is the hydrochloride of the artificial alkaloid Apomorphine, which is prepared from morphine or codeine by the action of strong acids or zinc chloride, the morphine losing in the process a molecule of water. The salt occurs in minute, colorless crystals, odorless, of bitter taste, and neutral or faintly acid reaction; soluble in about 45 of water and in the same quantity of alcohol at 59° F., almost insoluble in ether or chloroform; decomposed by boiling water or boiling alcohol. Dose, as an expectorant gr. $\frac{1}{10}$ – $\frac{1}{20}$ [av. gr. $\frac{1}{30}$]; as an emetic gr. $\frac{1}{15}$ – $\frac{1}{8}$ [av. gr. $\frac{1}{10}$]. For young children, gr. $\frac{1}{30}$ should not be exceeded. Solutions should be fresh when used, and as they alter rapidly by keeping should have a few drops of hydrochloric acid added to them, to prevent decomposition.

Injectio Apomorphinae Hypodermica, *Hypodermic Injection of Apomorphine* (B. P.),—has of Apomorphine Hydrochloride gr. j, Diluted Hydrochloric Acid ℞j, Distilled Water to ℞cx; and is a 1 per cent. solution. Dose, hypodermically, ℞v–x. Should be recently prepared.

Cotarnine, $C_{11}H_{12}NO_3(O.CH_3)$,—is a base produced from Narcotine by oxidation. The Hydrochloride (unofficial) has the trade name *Stypticin*, and occurs as a yellow powder, soluble in water and in alcohol. Dose, gr. j–v by the mouth or hypodermically, 4 or 5 times daily, as a uterine hemostatic and sedative.

Dionin (Unofficial),—the hydrochloride of the *mono-ethyl ester of morphine*, occurs as a white powder, soluble in 7 of water and in 2 of alcohol. It possesses the analgesic and narcotic properties of morphine but without its intensity, is probably the most innocuous of the morphine derivatives, and may be used in children. It does not seem to give rise to any habit when its administration is prolonged, and hence has been recommended in morphinism.

It is used by ophthalmologists as a local analgesic in 4 to 7 per cent. solution, and has been employed with satisfaction in whooping-cough and other coughs, dysmenorrhea, and cardiac affections. Dose, gr. $\frac{1}{4}$ – $\frac{1}{2}$; for children gr. $\frac{1}{10}$ to gr. $\frac{1}{2}$, according to age.

Heroin, (Unofficial),—is *diacetyl-morphine*, and occurs as a fine, white powder, insoluble in water, but soluble in dilute acids. It is one of the most toxic agents of the morphine group, and is considered even more poisonous than morphine itself, having a bad influence on the respiratory apparatus. Doses of gr. $\frac{1}{12}$ have caused suppression of urine and threatening coma (Cohen). It has been extensively used in cough and dyspnea, asthma, neuralgic affections, pertussis, and morphinism, and is an ingredient of many trade preparations widely advertised as cough syrups and remedies for asthma. Dose, gr. $\frac{1}{24}$ – $\frac{1}{8}$ in pill or powder, or in aqueous solution with a few drops of diluted acetic acid.

Peronin, *Benzyl-morphine*, (Unofficial),—is the hydrochloride of the *benzyl ether* of morphine, and occurs as a white powder, soluble in water, insoluble in alcohol, chloroform or ether. It produces sound sleep without previous excitement, and has been useful in allaying cough, also in relieving rheumatic and neuralgic pains. It is almost free from the by-effects of morphine. Dose, gr. $\frac{1}{4}$ –j in pill or in aqueous solution.

Other Alkaloids and their Preparations.

Codeina, *Codeine*, $C_{18}H_{21}NO_3 + H_2O$,—white or yellowish-white, rhombic prisms, efflorescent in warm air, of bitter taste and alkaline reaction, soluble in 80 of water and in 17 of boiling water, very soluble in alcohol, chloroform and ether. Dose, gr. $\frac{1}{4}$ –j [av. gr. ss.] but gr. $\frac{1}{8}$ has caused alarming symptoms in children. Much of the so-called codeine in the market consists largely of morphine.

Codeinae Phosphas, *Codeine Phosphate*,—white crystals of slightly bitter taste, soluble in 2½ of water and in 261 of alcohol. Is the most soluble salt of codeine and comparatively unirritant, hence it is well suited for hypodermic use in solution of 1 part in 20 of water. Dose, gr. $\frac{1}{4}$ –j [av. gr. ss.]

Codeinae Sulphas, *Codeine Sulphate*,—a crystalline powder, soluble in about 30 of water, and in 6½ of hot water. Dose, gr. $\frac{1}{4}$ –j [av. gr. ss.]

Syrupus Codeinae, *Syrup of Codeine*, (Unofficial),—has of Codeine Phosphate gr. xxxij, dissolved in Distilled Water ̄ijss, adding Syrup to ̄xv. Of this ̄j contains gr. $\frac{1}{4}$ of Codeine Phosphate. Dose, ̄j–iv.

Narcotinae Hydrochloridum, *Narcotine Hydrochloride*, (Unofficial),—Dose, gr. ij–x, as an antiperiodic.

Incompatibles.

Incompatible with *Opium* preparations are Alkalies, Alkaloidal precipitants (see page 5), Carbonates, Catechu, Cinchona, Copper salts, Galls, Iron salts, Kino, Lead Acetate and Subacetate, Lime-water, Mercuric Chloride, Silver Nitrate, Zinc Sulphate. With *Morphine Salts* are Alkaloidal precipitants (see page 5), Borax, Chlorates, Ferric Chloride, Iodates, Iodides, Iodine, Lead Acetate and Subacetate, Magnesia, Spirit of Nitrous Ether, Silver Nitrate. With *Apomorphine Hydrochloride* are Alkali Hydrates and Carbonates, and other alkaloidal precipitants (see page 5), Ferric Chloride, Iodides, Lime-water, Permanganates, Picric Acid, Tannic Acid, Silver Nitrate. With *Codeine* are Alkalies and other alkaloidal reagents (see page 6), Ichthyol, Salts of Copper, Iron and Lead. Physiological Incompatibles are Atropine, Caffeine, Chloral Hydrate (with apomorphine and codeine), Chloroform, Cocaine, Gelsemium, Hyoscyamine, Nicotine, Paraldehyde, Physostigmine, Picrotoxin, Strychnine (with apomorphine), Veratrum Viride.

Tests for Morphine.

Nitric Acid produces an orange-red color, turning yellow, then disappearing. Test-solution of *Ferric Chloride* gives a blue color changing to green with excess of the reagent, and destroyed by free acids or alcohol, but not by alkalies. *Iodic Acid* liberates Iodine which may be tested by starch. Vaughn has shown that certain intestinal ptomaines will give the same reactions with these reagents.

PHYSIOLOGICAL ACTION.

Opium is analgesic, hypnotic, antispasmodic, diaphoretic and narcotic. It first stimulates and afterwards depresses the cerebrum, heart and respir-

atory apparatus, and is classed among the cerebral depressants, though it kills by paralyzing the respiratory centres in the medulla.

In medium dose (gr. j) it diminishes all the secretions except the milk and the sweat, the latter being increased; producing dryness of the mouth and throat, retarded digestion from decrease of the gastric juice, and decided loss of appetite. The action of the heart is increased, arterial tension is raised and the pupils are slightly contracted. The cerebral faculties are stimulated to a pleasant activity by increased blood-supply, ideas follow each other rapidly through the mind, and an exhilaration bordering on mild intoxication is experienced, succeeded by a calm of variable length. Sleep generally follows, disturbed by dreams, and after waking, headache, malaise, constipation, digestive disturbance and some depression result. The conductivity of the nerves is not affected. Frequently the stage of mental activity is absent, but in persons habituated to the use of opium it is usually well marked. In some subjects a lengthened period of calm repose takes the place of sleep, in others neither calm nor sleep occurs, but the stimulant action of the drug prevails, the spinal functions as well as the cerebral are exalted, and great restlessness results.

In full dose (gr. iij) the same symptoms are produced but in greater intensity; the stage of stimulation is much shorter, digestion is arrested, nausea and vomiting produced, also profuse diaphoresis. The conductivity of the nerves is more or less impaired, the respiration, heart and circulation are depressed, oxidation being interfered with and the body-temperature lowered. The pupils are contracted by stimulation of the motor oculi through the basal ganglia, intense pruritus is produced, especially at the nose, and often spasmodic retention of the urine. Profound sopor soon comes on, with irregular and slow respiration, but in some subjects this is replaced by coma-vigil and delirium. After-effects are nausea, depression, constipation, racking headache, vertigo, anorexia, nasal pruritus, and fetid pathological secretions.

A *toxic dose* produces cold and clammy sweat, very slow pulse, slow and stertorous respiration gradually becoming feeble and irregular, cyanosed face, abolished reflexes, coma gradually deepening, the pupils minutely contracted but dilating as the end approaches, and finally death by paralysis of the respiratory centre. Postmortem examination shows only a wet brain, congested lungs, and engorgement of the venous trunks and of the right heart.

The *coma* produced by opium-narcosis, when deep and when a history of the case cannot be obtained, is almost impossible of differential diagnosis from that due to alcohol, apoplexy, uremia, epilepsy, etc. [See under ALCOHOL, page 110.] The *odor* of the breath may point to laudanum or some other preparation of opium. The *pupils* are very much contracted in opium poisoning (also from physostigma and chloroform), but they may dilate just before death (as with chloroform), due to the irritation of the centres by the excessive venous condition of the blood. In alcoholic coma they may be either contracted or dilated; and in apoplexy they are generally contracted unequally, though in apoplexy of the pons varolii they may be equally and minutely contracted. The *rectal temperature* may be an important

sign, for in most cases of apoplexy there is an initial fall of temperature with a subsequent rise. A previous history of *convulsions* points to epilepsy, and the presence of *albumin* in the urine, with sometimes edema of the legs, indicates uremia as the cause of the coma.

The principal action of Opium is exerted upon the nervous system, first affecting the cerebral convolutions, which are briefly stimulated and soon depressed. Next the perceptive and sensory centres in the higher brain are blunted, and the conductivity of the afferent nerves is impaired. Soon the ganglia at the base of the brain are involved, evinced by the contraction of the pupils, vomiting, and slowing of respiration; the cardiac, vascular and other centres are depressed, but to a less degree than the respiratory and perceptive. The gray matter of the cord, at first stimulated, as shown by the increase of reflex excitability, is also depressed, and locomotion becomes difficult, the motor nerves being paralyzed from the centre outward, but muscular irritability is never lost. Death occurs generally by paralysis of respiration, rarely by cardiac failure.

Metabolism is greatly reduced in activity by Opium, the quantity of urea excreted being markedly lessened, and the biliary and glycogenic functions of the liver being affected, resulting in whitish stools, perhaps jaundice, and certainly decided decrease of the sugar excreted by diabetics when the drug is given to them by the stomach.

The vaso-motor centre is slightly if at all affected by small doses of Opium, but large doses depress it. On the vessels of the skin the first effect of the drug is to cause their dilatation, shown by turgescence of the vessels of the external ear and a sense of heat therein, and often giving rise to a roseolous cutaneous eruption accompanied by itching. The continued use of opium causes marked contraction of the capillaries and arterioles throughout the body, the skin is excessively pale and the subject always feels cold at the ordinary temperature of the atmosphere. In those accustomed to its use it acts as a vaso-motor and cardiac stimulant, raising the blood pressure and increasing the force of the heart. The symptoms of its withdrawal are chiefly due to the fall in blood pressure which occurs when the habitual stimulus is removed.

On the uterine and generative functions Opium exerts a marked influence, stopping menstruation if its use be continued, and in men causing impotence. Both male and female functions, however, return as soon as the drug is discontinued, but the female organs of generation suffer atrophy from its long-continued use. In one case, intra-uterine measurements, taken during a period of two years, showed a diminution in the size of the cavity from 5.1 to 1.9 inches.

The hypnotic action of Opium is produced by a double influence: on the vascular system, causing anemia of the brain; and on the cerebral cells, diminishing their activity and lessening their demand for blood. Its constipating action is shown experimentally to be produced by stimulation of the inhibitory nerves of the intestines through the splanchnics.