Opium.—Opium. (Opium, Fr.; Opium, Ger.) The concrete milky exudation obtained in Asia Minor from the unripe capsules of Papaver somniferum, by incision and spontaneous evaporation. (Nat. Ord. Papaveraceae.) (U. S. P.)

Opium should yield at least nine per cent of morphine by the process of assay.

Opium Powder.—Powdered opium. Opium dried at a temperature not exceeding 180° F. and reduced to a moderately fine powder (No. 50). It should contain not less than twelve nor more than sixteen per cent of morphine. Dose, gr. j—gr. iij.

Opium Denocrostatum.—Denocrotized opium. Opium freed from materials soluble in ether—colorless matters, norticine, etc. It should contain fourteen per cent of morphine. Dose, gr. j—gr. iij.

Opium Deamnistratum.—Plaster of opium. (Extract of opium, Burgundy pitch, and lead-plaster.)

Extractum Opium.—Extract of opium. Dose, gr. ss—gr. iij.

Pilule Opium.—Pills of opium. Dose, one to four pills. Each pill contains one grain of opium.

Pulvis Ipecacuanhah et Opium.—Compound powder of ipecacuanha. Doerver's powder. Ten grains contain one grain each of ipecacuanha and of opium, and eight grains of sugar of milk.

Tinctura Opium.—Tincture of opium. Laudanum. Thirteen minims or twenty drops are equivalent to one grain of opium.

Acetum Opium.—Vinegar of opium. Ten minims or twenty drops are about equal to one grain of opium.

Tinctura Opium Camphorata.—Camphorated tincture of opium.

Paregoric. Half a fluid ounce contains nearly one grain of opium. Dose, for children, from ctt. v—catt. xx; for adults, from 3 j—5 j.

Troccholi Algyrophresi et Opium.—Troches of liquorice and opium. Dose, one to three or four.

Tinctura Opium Distilatata.—Desocrotized tincture of opium. Dose, m. v—5 j.

Vinosum Opium.—Wine of opium. (Opium, cinnamon, cloves, sherry wine.) Dose, m. v—5 j.

Composition.—About half of the weight of opium is made up of gum, pectin, albumen, fragments of the poppy-empules, and calcareous salts. It contains, also, some coloring-matter, and a volatile substance in minute quantity. The proportion of water varies from twelve to thirty per cent. A large number of basic, acid, and neutral substances have been and are still being discovered in opium, hence its chemistry is very complex.

The following natural alkaloids have been found in opium. Various derivatives of these have also been described. This list, except some unimportant modifications, is taken from Flüecker and Hambury's admirable Pharmacographie:

Hydrocortamine.—Crystallizable, alkaline. Volatile at 100°. (C,H,N,O.)

Morphine (morphinum).—Crystallizable, alkaline. (C,H,N,O.)

Pseudo-morphine.—Crystallizes with H₂O, does not unite even with acetic acid. (C,H,N,O.)

Cotinine (codinum).—Crystallizable, alkaline, soluble in water. (C,H,N,O.)

Thebaine (thebaina).—Crystallizable, alkaline. (C,H,N,O.)

Protamine.—Crystallizable, alkaline. (C,H,N,O.)

Laudanum.—An alkaloid, which, as well as its salts, forms large crystals. (C,H,N,O.)

Codamine.—Crystallizable, alkaline; can be sublimed. (C,H,N,O.)

Papaverina (papaverina).—Crystallizable, alkaline. (C,H,N,O.)

Rhodamine.—Crystallizable, not distinctly alkaline; can be sublimed. (C,H,N,O.)

Mecamidine.—Amorphous, alkaline; melts at 58°; not stable; the salts also easily altered. (C,H,N,O.)

Cryptophine (cryptopina).—Crystallizable, alkaline; salts tend to gelatine; hydrochlorate crystallizes in tufts. (C,H,N,O.)

Laudanetin.—Crystallizable, alkaline. (C,H,N,O.)

Narcotine (narcotica).—Crystallizable, not alkaline; salts not stable. (C,H,N,O.)

Lanthamine.—Microscopic crystals, not alkaline. (C,H,N,O.)

Narcotine (narcinea).—Crystallizable as a hydrate; readily soluble in buming water or in alkalies. (C,H,N,O.)

The only important derivative in the therapeutic sense is apomorphine, obtained from morphine by the action of hydrochloric acid. This possesses active emetic property, and will be grouped with emetics.

Besides the foregoing alkaloidal and basic substances, opium contains a peculiar acid (meconic acid), and, according to T. and H. Smith, a peculiar form of lactic acid (lobotactic).

The proportion of morphine in Turkey opium should not be less than ten per cent; and in good specimens may reach fifteen per cent. Pseudo-morphine occurs in the minute quantity of 0.04 per cent. The proportion of codeine varies from one fifth to two fifths per cent. Thebaine and papaverine exist in Turkey opium in about the proportion of one per cent. Narcotine is found in considerable quantity in different varieties of opium, and ranges in amount from one and five tenths to ten per cent. Narcotine varies from 0.1 to 0.71. The quantity of cryptopine and rhodamine is extremely small.

The morphine of opium exists in the drug in the form of the tri-basic meconate. The proportion of meconic acid is about three to four per cent of the crude opium.
The value of opium depends on the quantity of morphine which it contains.

**Morphine.**—**Morphina.** In colorless crystals, which are inflammable
and wholly dissipated by red heat. It is scarcely soluble in cold water,
slightly so in boiling water, and freely soluble in boiling alcohol.
Nitric acid first redinds it, and then renders it yellow. With a solution
of sesquichloride of iron, it assumes a deep-blue color. Its solution
restores the color of litmus, previously reddened by an acid.
(U.S.P.)

**Morphina Acetas.**—Acetate of morphine. A white, yellowish-white,
crystalline or amorphous powder, slowly losing acetic acid when kept
for some time and exposed to the air, having a faintly acetoxy
odor, a bitter taste, and a neutral or faintly alkaline reaction. When
freshly prepared, the salt is soluble in twelve parts of water and in
sixty-eight parts of alcohol; if it has been kept for some time, it is
incompletely soluble in water, unless a little acetic acid is added. Dose,
g. 1—gr. 8.

**Morphina Hydrargyrum.**—Hydrochlorate of morphine. In snow-white,
feathery crystals, wholly soluble in water and in alcohol. Dose,
g. 1—gr. 8.

**Morphina Sulphas.**—Sulphate of morphine. In snow-white, feathery
crystals, which are wholly soluble in water. Dose, gr. 1—gr. 8.

**Fadela Morphinæ Composita.**—Compound powder of morphine
(Tulley’s powder). (Morphine sulphate, one part; camphor, twenty
parts; glycerine, twenty parts; precipitated carbonate of calcium,
twenty parts; and sufficient alcohol to make a mixture.) Dose, gr. 1
—gr. x.

**Triodei Morphinæ et Ipecacuanha.**—Tincture of morphine and
ipecacuanha. (Morphine, ippec, sugar, oil of gaultheria, mudgall.)

**Codeina.**—Codeine. White, or yellowish-white, more or less transpar-
ent, rhombic prisms, slightly efflorescent in warm air, colorless,
having a slightly bitter taste and an alkaline reaction. Soluble in
eighty parts of water at 60° Fahr, and in seventeen parts of boiling
water; very soluble in alcohol and in chloroform; also, soluble in six
parts of ether. Dose, gr. ss—gr. ij.

Various salts of codeine are now prepared, but the sulphate is the
most important and desirable.

The other alkaloids of opium are not official.

**Narcotina Hydrochloria.**—Hydrochlorate of narcotine (not offi-
cial). Dose, gr. ij—gr. x, as an antiperiodic.

**Antagonists and Incompatibles.**—As regards chemical antagon-
ism, the alkaline carbonates, lime-water, and the salts of iron, lead,
copper, zinc, mercury, and Fowler’s solution, are incompatible with
the preparations of opium. Notwithstanding this chemical incomp-
atability, the metallic salts are frequently given in conjunction with
opium, and the systemic effects of both are produced. Astringent
vegetables (tanin) are also incompatible; they limit physiological
activity by forming tanate of morphine, which is not readily soluble.

In cases of opium-poisoning, if any portion of the drug remains
absorbed in the stomach, the most prompt and efficient emetic should
be used. Apomorphine should be injected subcutaneously, if the patient
is unable to swallow; if conscious, the sulphate of copper may be ad-
ministered by the stomach. In a case of opium narcosis which re-
sisted ordinary emetics, violent emesis was induced by a solution of
bicarbonate of sodium, followed by a solution of tartaric acid. In the
absence of other and more active emetics, powdered mustard may be
administered—a tablespoonful to a teaspoonful of warm water. When
the opium swallowed is in solution, the stomach-pump should be used
if the narcosis is profound. Cold affusion, artificial respiration, when
the breathing flags, and faradization of the chest-muscles, are measures
of great practical utility. The author has personally witnessed in
several cases the excellent effects of faradization, first, in causing such
irritation of the surface as to produce reflex excitation of the respir-
atory center; and, second, inducing contractions of the respiratory
muscles. As a peripheral irritant, faradization is more humane and
seemly, and also more efficient, than flagellation.

The action of opium is antagonized, at least in a part of the sphere
of its influence, by belladonna. These agents are opposed as regards
their influence on the intra-cranial circulation, on the pupil, on the res-
piratory organs, and on the heart. Opium in lethal doses dilates the
arterioles and veins; belladonna contracts them, and, by energizing the
cardiac movements, substitutes an active for a passive congestion. It
cannot too strongly insist on in this connection that belladonna
in too great quantity, or too long in action, exhausts the irritability
of the unstripped muscular fiber, and thus induces the very state
which its administration was intended to relieve. The state of the pupil, the
action of the heart, and the condition of the reflex movements, are the
guides to the administration of belladonna in cases of opium narcosis.
The smallest quantity of belladonna which will dilate the pupil, raise
the tension of the arterial system, deepen the respiration, and re-es-
ablish the reflex excitability, should be used. The author has a strong
conviction, arising from some painful personal experience, that it is a
fata! error to attempt to restore a patient in opium narcosis to com-
plete consciousness by repeated doses of belladonna. The action of
these agents combined is to produce profound sopor, and this is not a
condition of danger so long as the pulse, respiration, and reflex move-
ments are in good condition. To substitute belladonna narcosis for
opium narcosis is only increasing the hazard under which the patient
is already struggling. Impatient to afford relief, and assuming that the
tendency to sleep must be obliterated, the physician too frequently, as the history of many cases plainly shows, repeats the doses of belladonna until its action greatly preponderates, and the irritability of the cardiac ganglia is completely exhausted. The author, therefore, feels himself warranted in repeating that the utility of belladonna consists in its power to modify the action of the heart, and the respiration, until elimination has taken place, and that even coma is of little importance provided the respiration, circulation, and reflex movements are properly maintained.

The hypodermatic injection of atropine is the most efficient and satisfactory method of employing this physiological antagonist. Not more than 1/40 of a grain of the sulphate should be administered at a dose, and this may be repeated every fifteen minutes (up to three doses) until dilatation of the pupil, increased power of the cardiac movements, deeper respiration, warmth and dryness of the skin, and flushing of the face, are produced. No more can be accomplished by the largest doses, and the results of the antagonism must be awaited. Belladonna continues longer in action than opium. In a succeeding chapter, devoted to the consideration of the combined administration of opium and belladonna, or morphine and atropine, the nature and degree of the antagonism will be more fully elaborated.

Coffee, with its active principle (caffeine), is also an antagonist to opium. Good results have undoubtedly been obtained by the free use of black coffee, in milder cases of opium narcosis. The unpleasant confusion of mind, and vertigo, which in so many subjects are experienced after the subsidence of the effects of a medicinal dose, may sometimes be removed by a cup of strong coffee. These cerebral effects may be prevented, or relieved when they occur, by a full dose of bromide of potassium. This discovery, if we may dignify so small a matter by so imposing a title, was briefly announced by the author in the first edition of his work on "Hypodermatic Medication," and was afterward more fully set forth in a special memoir by Dr Costa, of Philadelphia.

Guibler has shown that some of the cerebral effects of opium are antagonized by quinine. Tartar emetic and digitalis also oppose to some extent the action of this remedy on the intra-cranial circulation.

Synergists.—The cerebral and hypnotic effects of opium are promoted by alcohol and its derivatives (notably chloral), and, within certain limits, by the myrtiratics. The sudorific action of opium is increased by ipecacuanha.

Physiological Actions.—As opium is a very complex substance, made up of numerous principles which differ remarkably among themselves, it will conduce to a better understanding of its actions to consider, first, opium as a whole, and then follow with some details regarding its individual constituents.

The physiological effects of opium are best studied as respects—1. Small medicinal doses; 2. Full medicinal doses; 3. Lethal doses.

1. The preparations of opium have a disagreeable, bitter, and rather nauseous taste. Dryness of the mouth and fauces, puckering of the tongue, and diminution in the sense of taste, occur in a short time after administration of the drug has begun, and continue during the whole period of its influence. To the dryness succeeds a viscid secretion, which contains excrementitious matter having a foul odor. When opium does not produce nausea, the appetite may not be impaired, may be even increased; but the rule is that the desire for food is lessened by opium. The secretion of mucus, and of the special glandular apparatus of the gastro-intestinal mucous membrane, is lessened by opium, and hence the digestion and peristaltic movements are less active. The evacuations being thus checked up, dulness and hebetude are experienced, the skin looks muddy, the tongue is coated, and the breath is offensive. When the influence of the opium ceases, it not unfrequently happens that the constipation is succeeded by relaxation of the intestines, and rather profuse and fetid evacuations, and increased urinary discharges, take place.

2. The action of the heart becomes stronger, and the arterial tension rises.

When opium agrees, the sense of fatigue vanishes, and muscular movements become more rapid and easy. The face flushes a little, the pupil contracts slightly, the conjunctivæ may be somewhat injected, and the expression of the eye more brilliant. At this stage the ideas flow more rapidly, but are less sustained and orderly. The appreciation of time, the sequence of events, and the sense of moral fitness, are diminished. The cerebral excitement is, after a period which varies in different individuals, succeeded by calm, by drowsiness, and sleep when it occurs is usually disturbed by visions and dreams, often of a frightful character. In most subjects, after the sopor has passed off, headache, vertigo, confusion of mind, nausea, constipation, and muscular hebetude, are experienced.
respirations, a perspiring skin, and, in many persons, an intense general pruritus, which, however, is more harassing at the nasal orifices.

Persons not accustomed to the use of opium usually experience, after a full medicinal dose has expended its force, very distressing sequelae, referable to the cerebro-spinal system. The most important of these after-effects are headache, confusion of mind, vertigo—which is especially severe on assuming the erect posture—nausea, retching and vomiting, complete anorexia, and constipation. A mild but definite hepatic jaundice not infrequently occurs, and the urine is tinged with the coloring-matter of the bile.

5. A lethal dose of opium causes but a transient excitement; the stage of narcosis quickly supervenes, and the functions of animal life are often rather abruptly suspended. The patient soon lapses into a condition of insensibility, with a low and feeble, or, it may be, rapid and feeble, action of the heart; slow respiration, shallow and quiet or stertorous; face at first flushed, but soon becoming shrunk, pallid, and cyanosed; skin wet; pupils minutely contracted and insensible to stimulation; unconsciousness profound, with muscular relaxation and abolition of reflex movements. This state of opium narcosis is with difficulty distinguished from alcohol narcosis, from cerebral hemorrhage—especially in the pons—and from uremic coma. An attentive consideration must be given to all available facts in the history of the case, to the surroundings of the patient, and to the odor of the breath or other excretions, for the symptoms of one of the states above mentioned may be represented in another, even to the inequality of the pupils, since a case of opium narcosis has been reported in which such inequality existed.

There are no characteristic structural alterations produced by opium. The brain presents the appearance known as the "wet brain" by pathologists; the subarachnoid spaces and the ventricles contain an abnormal quantity of serum; the intra-cranial veins are engorged, and the ponentes convoluti are somewhat more numerous. The right cavity of the heart and the large venous trunks are usually distended with soft coagula. These appearances are largely due to the mode of dying. In consequence of the diminishing frequency of the respiratory movements, the blood is imperfectly decarboxylated, and the capillary circulation of the lungs is impeded. The action of the heart being weak and the resistance a præsens increased, it is obvious that venous stasis must take place.

It is necessary now to consider somewhat more minutely the nature and degree of the action of opium on the different organs and systems of the body. It will save space and avoid repetitions to study these actions in connection with the several principles contained in opium.

THE PHYSIOLOGICAL ACTION OF THE ALKALOIDS OF OPIUM.—I.

Morphine.—The peculiar powers of opium are represented chiefly in the morphine which it contains. In opium of good quality the proportion of morphine is from ten to fifteen per cent. The actions of the other principles contained in opium differ widely; and as they all possess some activity, the sum of their effects must so far influence the result that the powers of opium and morphine must vary somewhat in kind as well as in degree. One sixth of a grain of morphine is about equivalent in activity to one grain of average opium.

In general terms, it may be stated that morphine differs from opium in the following respects: Morphine is less stimulating, less convulsant, and more decidedly hypnotic and analgesic than opium.

Morphine constipates less and affects the contractility of the bladder more than opium.

Morphine has less diuretic action and produces much more pruritus than opium.

The physiological action of morphine is best studied as administered subcutaneously. In a short period—from a few seconds to a few minutes—after the insertion of an ordinary dose—one sixth to one fourth of a grain—under the skin, the symptoms of morphine narcosis begin. A sense of heat and flushing of the face—after, in most subjects, a very transient pallor—fullness of the head, giddiness, tinctorius aureus, and frequently nausea, are experienced. Deep-seated epigastric pain is often felt, and loud borborygmi occur. The vertigo may be so considerable as to render walking uncertain and staggering, or to render the upright position impossible. Injection of the conjunctive and contraction of the pupils occur at the same time the cerebral effects are experienced. The lips have a bluish appearance, the mouth and tongue become dry, swallowing is painful, and the voice has a husky tone. When these physiological effects are produced, pain and spasm are relieved, and an indescribable feeling of content takes possession of the mind. A condition of somnolence in many persons, in others of extreme wakefulness, with intense mental activity, is experienced. When sleep occurs, it is usually deep but not calm, the respirations are slow, noisy, and labored. Not infrequently the sleep is disturbed by dreams and visions, or the individual passes into a somnambulistic state, from which he is aroused with difficulty. The action of the heart is diminished in frequency, but a decided rise takes place in the arterial tension. On ophthalmoscopic examination, a marked increase in the vascularity of the retina, and blurring of the papillæ, can be discerned.

Soon after a hypodermatic injection has been practiced, itching of the nose, and often of the whole cutaneous surface, is experienced. The skin is at first dry, but, after a time, diaphoresis begins and is sometimes profuse. The relaxation of the skin is coincident with a
fall in the arterial tension. The secretions of the mucous surfaces are
at first arrested, as well as those of the skin. If the morphine be ad-
ministered after a full meal, digestion is suspended for a time. The
intestinal movements are also arrested for a short period, and consti-
pation is therefore produced; but, very frequently indeed, no change
takes place in the time in which the urinary discharges occur, or in their
number. Partly in consequence of the increased action of the skin,
the quantity of urine discharged is lessened, and, at the same time,
difficulty is encountered in its emission. When the desire is felt, an
interval of less or greater duration elapses before the flow begins, and,
as the contractile power of the bladder and of the ejaculatory mus-
cles is diminished, the discharge is feeble and slow, and the last drops
linger in the urethra.

With the decline of morphine narcosis a majority of subjects, prob-
ably, experience headache, confusion of mind, anorexia, and nausea.

When a lethal dose of morphine has been administered by any
mode, profound narcosis quickly ensues; the pulse becomes slow and
feeble, or rapid and feeble; the respiration also become very slow
and shallow; the skin cold and sweating; the face pale, cyanosed, and
ghostly; the conjunctive deeply injected; the pupils minutely con-
trated, and reflex movements entirely abolished. Respiration ceases
before the action of the heart, as a rule, but in some instances very
sudden death ensues from paralysis of the heart.

Half a grain is the smallest dose of morphine which has proved
fatal to an adult. Five cases, according to Taylor, have been recorded
in which one grain of the muciate caused death.

A consideration of the symptoms produced in man by morphine,
and the results of experiments on animals, prove that it chiefly affects
the cerebro-spinal functions. In the lower animals, the spinal more;
in man, the cerebral more than the spinal functions. Morphine first
raises and afterward lessens the action of the heart and arteries; first
stimulates the pneumogastric end-organs and cardiac motor ganglia,and afterward paralyzes both. It causes death chiefly through paral-
ysis of the muscles of respiration.

2. Codeine.—According to the author's observations, the codeine of
commerce corresponds closely in action to morphine, but is much fee-
bler. Four grains of codeine are about equivalent to one grain of
morphine. It has anodyne and hypnotic qualities. Codeine produces
sleep free from disturbance, and the after-effects are less disagreeable,
than those of morphine. The special direction to the pneumogastric
nerve ascribed to it by some observers, seems to the author to exist in
nature.

2. Narceine.—This alkaloid is singularly inappropriately named.
It has but feeble narcotic power. In children considerable doses pro-
duce a calming effect and drowsiness, but these results are not ob-
served in adults. Experiments on animals have shown that narceine
is a convulsant. While pigeons are poisoned only by two or three
grains of morphine, administered subcutaneously, the same quantity
of narceine causes fatal convulsions. The reverse is true in man.
Narceine is allied in action to berberine, and alkaloids of that group,
so far as the effects on man are concerned; and to thebaine, piro-
toxin, strychnine, and brucine, so far as the effects on animals are
concerned.

4. Narceine.—The most contradictory observations have been pub-
lished on the action of this principle. By Bernard, Béchier, and Eu-
enburg, it is held to possess remarkable hypnotic power, and to be
free from stimulating and convulsant action; by Prommiller, Harney,
Da Costa, Mitchell, and others, it is considered feeble, if not inert.
The physiological actions of narceine, therefore, remain sub jedic.
Until further researches are made with chemically pure narceine, and
by competent observers, it will be safer to give no opinion on the sub-
ject of its actions and uses.

The other alkaloids of opium are curiosities of chemical and physi-
ological research, and may be dismissed in a few words.

Cryptopine is in a much greater degree than narceine an hypnotic
and analgesic.

Thebaine has a much greater action in animals.

Various circumstances modify the action of opium. These are
chiefly age, sex, idiosyncrasy, habitual use, and certain states of the
system, as the presence of pain, uremia, etc.

The extremes of life are relatively more susceptible to the action
of opium, and especially is the susceptibility to its action great in
early life. Fatal opium narceine has ensued in a nursing infant whose
mother had taken a medicinal dose. A single drop of laudanum has
produced lethal effects in a child under six months of age. Women
are more easily affected by opium than men, and they are more apt to
be thrown into a condition of hysterical excitement than put to sleep.
Nausea, vomiting, headache, and depression, much more frequently
occur in women than in men. As a rule, therefore—but to this rule
there are, of course, numerous exceptions—women are less favorable
subjects for the administration of opium than men.

More than age or sex is the action of opium influenced by idiosyn-
crasy. There are persons so easily affected by it that the minutest
quantity will cause uncontrollable vomiting, faintness, vertigo, and
alarming prostration. It is never safe to administer morphine hypo-
thermatically to such subjects, unless in an extremely small dose.

The habitual use of opium diminishes in a remarkable degree the
susceptibility to its action. Numerous instances are on record in which
a pint or more of laudanum has been taken daily, or several hundred