the action irregular. Homotropine also antagonizes the action of pilocarpine, but it requires relatively more than of atropine to accomplish this result. Ringer sums up his observations with the remark, "Homotropine, then, appears to possess many of the properties of atropine, but in a weaker degree."

Tweedy remarks that, as regards the action of atropine and homotropine relatively on the eye, the action of homotropine on the iris and ciliary muscle is really very powerful while it lasts. It widely and fixedly dilates the pupil in from fifteen to twenty minutes, and it acts on the accommodation in an equally rapid manner. Its effects pass off rapidly, and in twenty-four hours the accommodation is restored, although the pupil is yet a little dilated. The application of homotropine solution to the eye is entirely unirritating. For these reasons homotropine becomes a valuable substitute for atropine in ocular therapeutics, but it can not be substituted for atropine in the general diseases in which the latter has been found useful.

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Note.—Other references omitted for lack of space, but they are to be seen in all editions previous to the fourth.

Stramonium.—Leaves and seed of *Datura stramonium* Linné (Nat. Ord. *Solanaceæ*). (U. S. P.) *Stramoine*, Fr. ; *Stechapfel*, Ger.

Stramonii Folia.—Stramonium-leaves.

Stramonii Semen.—Stramonium-seed.

Extractum Stramonii.—Extract of stramonium. Dose, gr. $\frac{1}{6}$—gr. ss.

Tinctura Stramonii.—Tincture of stramonium. Dose, ♏ v—℥ ss.

Extractum Stramonii Fluidum.—Fluid extract of stramonium. Dose, ♏ j—♏ v.

Composition.—The alkaloid of stramonium—*daturine*—is chemically and physiologically nearly identical with *atropine*. It is contained in the seeds in the proportion of about one tenth per cent, and in the leaves in much smaller quantity. It exists in the plant in combination with malic acid. The seeds contain a fixed oil in considerable quantity.

Antagonists, Incompatibles, and Synergists, are the same as for belladonna. In the case of poisoning by stramonium, which is not uncommon in this country, the seeds, which usually are taken by children, must be evacuated by an emetic. Unless distinct symptoms follow, no further treatment may be necessary ; if, however, marked dilatation of the pupil, hallucinations, and active delirium are produced, the physiological antagonist becomes necessary. Tincture of opium should be administered until some contraction of the pupil, lessening of the pulse-rate, and cessation of the delirium, occur. If then, normal sleep comes on, the pupil, heart, and lungs functionating normally, no further interference will be necessary. In cases of poisoning in children, it is particularly desirable to employ the opium with caution, since opium narcosis may readily be substituted for stramonium-poisoning.

Hyoscyamus.—Leaves of *Hyoscyamus niger* Linné (Nat. Ord. *Solanaceæ*), collected from plants of the second year's growth. (U. S. P.) *Jusquiame*, Fr. ; *Bilsenkraut*, Ger.

Extractum Hyoscyami Alcoholicum.—Alcoholic extract of hyoscyamus. Dose, gr. $\frac{1}{6}$—gr. j.

Abstractum Hyoscyami.—Abstract of hyoscyamus. Dose, gr. ss—gr. ij.

Extractum Hyoscyami Fluidum.—Fluid extract of hyoscyamus. Dose, ♏ v—℥ ss.

Tinctura Hyoscyami.—Tincture of hyoscyamus. Dose, ℥ ss—$\frac{ʒ}{ʒ}$ ss.

Composition.—Hyoscyamus contains an active principle (*hyoscyamine*), a fatty oil, and the leaves are rich in nitrate of potassium. The seeds possess a larger quantity of hyoscyamine than the leaves.

Hyoscyaminæ Sulphas.—Sulphate of hyoscyamine. The neutral sulphate of an alkaloid prepared from hyoscyamus. Small golden-yellow or yellowish-white scales or crystals, or a yellowish-white, amorphous powder, deliquescent on exposure to air ; odorless, having a bitter and acrid taste, and a neutral reaction ; very soluble in water and in alcohol. (U. S. P.) Dose, gr. $\frac{1}{60}$—gr. j.

Antagonists, Incompatibles, and Synergists, are the same as for belladonna. The observation of Ladenburg, that hyoscyamine and duboisine are identical, is important, and if confirmed will facilitate the introduction of the latter into practice. As hyoscyamine is difficult to procure and very expensive, and as duboisine, on the other hand, will probably be very readily procured in any quantity, it is certain that the latter will be substituted for the former. Chemical facts of this kind must be acted on with caution. Identity of chemical constitution does not always mean identity in physiological action

and in therapeutical power. Differences in molecular arrangement, not appreciable by chemical analysis, may influence, to a great extent, the mode of action. The clinical facts do not, thus far, warrant the adoption of the view that hyoscyamine and duboisine are mutually convertible.

Physiological Actions.—As atropine, daturine, and hyoscyamine are similar if not identical in chemical composition and in physiological action, the remarks already made in regard to the actions and uses of belladonna are applicable to stramonium and hyoscyamus.

To these alkaloids must be added duboisine, which by Ladenburg is held to be identical with hyoscyamine. Studied from the physiological standpoint, daturine and hyoscyamine are regarded as identical in their effects by Oulmont and Laurent. As daturine is not employed, owing to its scarcity, and as hyoscyamine has been the subject of considerable study and clinical observation, we refer, in the following remarks, wholly to this alkaloid.

Hyoscyamine, as it occurs in commerce, prepared chiefly by Merck, of Darmstadt, is in two forms, a yellowish-white crystalline solid, which is represented as chemically pure, and a dark, resinous mass, having a strong, mouse-like odor, which is rather a concentrated extract, but appears to be little if at all inferior to the pure alkaloid. It is recommended by Prideaux to dissolve it in a mixture of sulphuric ether, alcohol, and water, in the proportion of one grain to twenty minims—alcohol eight minims, spirit of sulphuric ether six minims, and water ten minims. It may be administered, hypodermatically, in this form, or, if too strong, by the addition of equal parts of spirit and water; and it may be prepared for internal use from the above solution, by adding water and any flavoring sirup. The hydriodate is, however, the best form for administration, as it is freely soluble in water. The great variations in the dose of the alkaloid are due to the fact that much of the so-called hyoscyamine is merely a concentrated extract. The dose, by subcutaneous injection, ranges from one sixtieth of a grain to one fourth, and by the stomach from one sixtieth to one grain.

Hyoscyamine causes the same dryness of the mouth, dilatation of the pupils, flushing of the face, rapid action of the heart and of the lungs, the busy delirium with hallucinations and illusions, which are caused by atropine, but its effects in these directions are less in degree. In the various observations which have now been made on man, with the considerable doses which have been found necessary in some cases, it has been definitely ascertained that hyoscyamine has somewhat less than atropine of the deliriant action and much more hypnotic effects. As regards the mechanism of its action on the pupil, on accommodation, on the heart and respiration, there is no actual difference between the two alkaloids.

The elaborate investigations of MM. Oulmont and Laurent have conducted them to the following conclusions: Hyoscyamine and daturine act especially on the sympathetic system, in small or moderate doses, stimulating the vaso-motor fibers and raising the arterial tension, and in large doses paralyzing the vessels and lowering the arterial tonus. These effects are produced after section of the vagi. These alkaloids differ in the effect on the heart—hyoscyamine rendering the cardiac movements more regular, and daturine causing intermittence. By direct contact, both alkaloids slow and finally stop the heart's action. Both accelerate the respiratory movements. In moderate quantity both increase the intestinal movements; in large doses arrest them. As regards the nervous system of animal life, they are both without action on the motor functions, but in toxic doses they blunt the cutaneous sensibility. They do not affect the contractility of muscular fiber. Their action in dilating the pupil is due to stimulation of the sympathetic, and not to paralysis of the third nerve. The various phenomena arising from the administration of these alkaloids are referred by Oulmont and Laurent to the circulatory disturbances—to the increased distribution of blood. The action is soon ended, the alkaloids being eliminated by the urine.

Notwithstanding the freedom with which hyoscyamus and its alkaloid, hyoscyamine, are given, rarely are there any unpleasant effects. Empis, however, has reported some cases in which toxic symptoms happened from medicinal doses. These must have been examples of idiosyncrasy, for in the discussion which ensued, Joffroy, Damaschino, and others, expressed themselves strongly against the probability of serious effects from doses within safe limits.

Therapy.—The possession of decided hypnotic qualities has led to the use of hyoscyamine in the treatment of various *mental disorders* (Prideaux, Lawson, and others). Prideaux makes the important practical distinction, that it acts with different degrees of rapidity and potency under varying conditions of insanity. In *acute mania* with depression, one sixteenth of a grain will have a marked effect, while in the excitement of chronic mania large doses will be necessary. In *chronic mania* with exacerbations, he gives one quarter, one half, and even one grain by the stomach, or one tenth of a grain subcutaneously. The latter mode of administration he regards preferable in these cases. In cases of mania with great motor excitement, and of a destructive character, Prideaux regards hyoscyamine as "the most rapid and reliable narcotic we possess." In the *epileptic mania* of the epileptic status, he says, it diminishes the number and violence of the attacks. In *delusional insanity* he finds it brings about, under favorable circumstances, mental restoration. In *chronic dementia*, with destructive tendencies and sleeplessness, improvement is sometimes noted from the persistent use of small doses. Reinhard also has administered this.

agent in the dose of a milligramme (about one fifteenth of a grain) subcutaneously in cases of *mania* and *epilepsy*, with distinctly good results. In eight of fifteen cases of mania, calmative effects were produced and permanent good was accomplished; and in five of twelve epileptics with maniacal attacks, the number and severity of the seizures were lessened. Drs. Sapilli and Riva, eminent Italian alienists, have found hyoscyamine very useful in *recurrent mania*. Gill, Ringer, and Lawson have also had good effects from hyoscyamine, in suitable cases, as an hypnotic.

Stramonium and hyoscyamus may be used like belladonna for the relief of painful affections, the *neuralgiæ;* but they possess no special advantages over their more powerful congener. Oulmont has used the hypodermatic injection of hyoscyamine with remarkable success in several cases of neuralgia, but he does not regard it as more conspicuous and rapid in this disease than are opium and belladonna. Stramonium is used with advantage in the treatment of *dysmenorrhœa*. ℞ Ext. stramonii, ext. hyoscyami, ext. opii, āā gr. vj. M. Ft. pil. no. xij. Sig.: *One pill every three, four, or six hours.* This combination gives great relief in dysmenorrhœa, and may also be serviceable in neuralgia.

In affections characterized by *spasm*, as *asthma*, *laryngeal cough*, *hepatic*, *intestinal*, *renal*, and *uterine colic*, stramonium and hyoscyamus may be given with advantage, in place of or in combination with belladonna. The hypodermatic injection of hyoscyamine or daturine is an excellent expedient for procuring relief in these cases, but these alkaloids are not more effective than atropine. Hyoscyamus, especially in the form of tincture, is frequently prescribed in *irritable states of the bladder* due to the presence of stone, enlargement of the prostate, and in catarrh of the bladder arising by transference of irritation from the urethra. It should not be forgotten that liquor potassæ, so much prescribed in a mixture with hyoscyamus, is incompatible.

M. Oulmont refers, in terms which may seem to be exaggerated, to the great efficiency of hyoscyamine in the treatment of *mercurial tremor*, *senile tremor*, *paralysis agitans*, *locomotor ataxia*, and *tetanus*. In *mercurial* and *senile tremor* cures were obtained, but, as might be expected, only amelioration in *paralysis agitans*, *locomotor ataxia*, and *tetanus*. The remarkable benefit obtained from this remedy in paralysis agitans is testified to by Empis, Joffroy, Charcot, and many other observers. The dose which Oulmont found effective was the one thirty-second of a grain of hyoscyamine, gradually increased to the one fifteenth of a grain.

The *hypnotic quality* is much more conspicuous in hyoscyamus than in belladonna or stramonium. In children it has long been known that, when opium is not well borne, hyoscyamus is an efficient substitute. Recent experience in asylum practice has shown that hyoscyamus in large doses is a very valuable hypnotic. According to Dr. Campbell, two and a half drachms of the tincture are equivalent in hypnotic power to thirty grains of chloral hydrate. In order to procure efficient hypnotic effects, from two drachms to an ounce of the tincture is necessary, and this large quantity appears to be free from danger.

Extract of hyoscyamus is used in *combination with purgatives*, with the object—which abundant clinical observation confirms—of rendering their operation more efficient, and, at the same time, less drastic.

The ointment of stramonium is a favorite application to *irritable ulcers*, *superficial inflammations*, etc.

Hyoscine.—This is a new alkaloid obtained artificially from hyoscyamus by Ladenburg. It forms a crystalline combination with hydriodic acid, and an amorphous salt with hydrochloric. These salts dissolve freely in water. The solution employed by Edfelsen for administration by the stomach contained about $\frac{1}{70}$ gr. to the tablespoonful, and for subcutaneous injection, $\frac{1}{100}$ gr. to one minim. These are suitable doses for administration.

The physiological effects of *hyoscine* have been studied by Ladenburg, the discoverer; by Edfelsen, and others. Generally speaking, the effects of this agent correspond quite closely to those of atropine, but in corresponding doses the latter is more powerful. When administered subcutaneously, hyoscine acts in two to twelve minutes, by the stomach in about fifteen minutes. It causes more drowsiness and sopor, and less delirium than atropine, but like the latter dilates the pupil, increases the rate of the cardiac and respiratory movements, and reddens the skin. According to Gnauck, the pulse is first slowed eight to twenty beats per minute, and after ten to twenty minutes rises. The same phenomenon is observed from atropine in some subjects, but is not so pronounced. Dilatation of the pupil does not always occur after the stomachal administration. Sleep comes on in twenty to thirty minutes, preceded by a feeling of lassitude, and is deep and quiet, but is followed by headache and vertigo.

Instilled into the eye, hyoscine is a more energetic mydriatic than atropine, dose for dose (Emmert). One part of the hydriodate to one thousand of water is the solution used by Emmert, and this he finds more active than a half-per-cent solution of atropine.

Hyoscine has been employed in various diseases requiring a soporific and anodyne agent. In general, it can be used in the same cases as atropine, but, as it possesses more decided antispasmodic effects, it may prove more valuable. By Ladenburg it has been used successfully in *whooping-cough*, in *asthma*, and in *enteralgia*. Half the cases of whooping-cough were relieved, and all of the cases of asthma were more or less benefited, some decidedly so.

In ophthalmic practice, hyoscine can be substituted for atropine. It causes more prompt and decided, but less persistent, dilatation of

the pupil, and it is less poisonous (Emmert). It is applicable to the same purposes in eye-diseases as those in which atropine is now employed.

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Prideaux, E. *The Action and Uses of Hyoscyamine. Lancet*, 1879, September 27, October 4 and 11.

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Duboisia.—*Duboisia myoporoides*, of the *Solanaceæ*.

Preparations.—There are no official preparations. It has been used chiefly in the form of extract, and salts of the active principle. The dose of the extract is gr. $\frac{1}{6}$—$\frac{1}{4}$.

Composition.—The important constituent is an alkaloid—*duboisine*—which possesses the medicinal powers and properties of the plant. It combines with acids to form salts which are freely soluble in water. As regards its chemical relations, duboisine strongly resembles atropine, but differs in some particulars; according to Ladenburg, duboisine is identical with hyoscyamine. The dose of a salt of duboisine is $\frac{1}{100}$ to $\frac{1}{60}$ of a grain.

Antagonists and Incompatibles.—The caustic alkalies destroy the active principle, and consequently prescriptions containing them will be inert, except as to the effects of the alkali. The physiological antagonists are the same as those of atropine; thus physostigmine and muscarine counterbalance the action of duboisine in almost the entire range of power, and opium in a limited degree. Duboisine antagonizes pilocarpine, as respects, at least, the most conspicuous and important properties of the latter. In case of poisoning, emetics and the stomach-pump must be used, and the systemic effects opposed by the subcutaneous use of physostigma, muscarine, or morphine, cautiously, and

possibly pilocarpine; but further researches are necessary as to the antagonism of the last named.

Synergists.—The actions of duboisia are promoted by the other agents of the group, especially by belladonna, stramonium, and hyoscyamus. The effects of atropine and duboisine correspond to a remarkable extent, but there are points of difference, as follows: Duboisine is twice or more soluble in water than atropine; it has stronger basic properties, and it reacts differently to sulphuric acid and bichromate of potassa; it is less irritating to the conjunctiva, dilates the pupil more promptly, and its effects subside earlier (Gerard).

Physiological Effects.—Dryness of the mouth, thirst, and some difficulty in swallowing, soon follow the administration of duboisia, and more speedily after the subcutaneous injection of the alkaloid. The pulse is considerably accelerated; the arterial tension rises, the face flushes, the pupil dilates, and the accommodation is paralyzed. Some frontal headache, tinnitus aurium, giddiness, and restlessness, especially in sleep, are experienced. Certain motor symptoms—uncertain gait, awkwardness of movement in walking, and muscular paresis—occur (Gubler). In animals mental excitement or delirium has been noted, but no confirmatory or opposing observations on man have thus far been reported. The tetanic symptoms which occur after some days in frogs poisoned by atropine, take place under the same conditions from duboisia.

The acceleration of pulse and rise of tension first produced by duboisia do not persist; the pulse-rate and the tension fall after some hours, the excitement subsides, and a condition of stupor comes on which is not sleep, although it favors sleep (Gubler). I can confirm these important observations on the cerebral effects of duboisia.

Therapy.—Thus far duboisine has been used only in ocular therapeutics. The author has prescribed it in a case of *puerperal mania* with excitement, on the suggestion of M. Gubler, and with apparent advantage. There was always an increase of the maniacal excitement for a few hours after the hypodermatic injection, but this was followed by the condition of stupor and mental calm. The improvement was rapid, and followed so closely the administration of the remedy that he could not doubt it was *propter* and not merely *post hoc*.

As respects its use in ophthalmic diseases, it may be stated in general that duboisine is applicable under the same conditions as atropine, to which it is to be preferred, in many cases, it is probable.

The advantages of duboisine, as compared with atropine, are its greater rapidity of action in effecting *dilatation of the pupil* and *paralysis of accommodation*, the less irritation of the conjunctiva, and the more rapid recovery from the effects. It is, therefore, much more useful than atropine for determining the refraction of the eye, and for use in ocular therapeutics in general.

Some unpleasant cerebral effects have been observed after instilla-

tion into the eye (Seely). The author was given the opportunity, by the kindness of Dr. Seely, to examine the patient—the first instance in which such phenomena were observed—who experienced faintness and strange sensations in the head ; but they were entirely subjective and mental, as no change in the circulation or respiration was to be seen. Since that case there have been several examples of the systemic action of duboisine after its instillation into the eye.

To relieve the *night-sweats* of phthisis and the various *neuroses of the respiratory organs*, and to *stimulate the action of the heart*, duboisine may take the place of atropine. As an antagonist to morphine it is equally as effective as atropine, but, as a hypnotic and anodyne, superior to the latter.

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B.—AGENTS EXCITING THE FUNCTIONAL ACTIVITY OF THE CEREBRUM.

To this group belong those remedies usually classed together under the designation of *antispasmodics*. They are to a slight degree cardiac stimulants ; they increase the cutaneous circulation, and promote diaphoresis ; they also stimulate the bronchial mucous membrane, and favor expectoration. As a result in part of the increased rapidity of the circulation, the functions of the brain become slightly more active, ideas flow more freely, irregular mental excitement and muscular hyperkinesis are moderated, and an orderly feeling of well-being is established. These effects are probably in part due to a direct action of these agents on the gray matter of the hemispheres, but our knowledge does not at present permit an exact statement of the nature of this impression. These agents do not in any quantity suspend the functions of the brain, and the temporary increase of activity which they produce is not followed by manifest depression.

Camphora.—Camphor. *Camphre*, Fr. ; *Campher*, Ger. A stearopten derived from *Cinnamomum camphora* F. Nees et Ebermaier (Nat. Ord. *Lauraceæ*), and purified by sublimation. (U. S. P.)

Aqua Camphoræ.—Camphor-water. Dose, ʒ j—ʒ j.

Linimentum Camphoræ.—Camphor-liniment. (Camphor, 20 parts ; cotton-seed oil, 80 parts.)

Linimentum Saponis.—Soap-liniment. (Soap, camphor, oil of rosemary, alcohol, and water.)

Spiritus Camphoræ.—Spirit of camphor. (Camphor, 10 parts ; alcohol, 75 parts ; water, 20 parts.) Dose, ɱ v—ɱ xx.

Camphora Monobromata.—Monobromated camphor. Dose, grs. ij—grs. x. Colorless, prismatic needles or scales, permanent in the air and unaffected by light, having a mild camphoraceous odor and taste, and a neutral reaction. Almost insoluble in water ; freely soluble in alcohol, ether, chloroform, and fixed oils ; slightly soluble in glycerin.

Composition and Properties.—Camphor is found in colorless, translucent, crystalline masses. One part dissolves in about 1,300 parts of water, but it is freely soluble in alcohol, ethers, oils, chloroform, bisulphide of carbon, etc. Its odor is peculiar and characteristic. The formula for camphor is the following : $C_{10}H_{16}O$. By distillation with chloride of zinc it is converted into *cymol*, and by oxidizing agents into *camphoric* and *camphretic* acids.

Antagonists and Incompatibles.—The addition of water precipitates camphor from its spirituous solution. Alkaline and earthy salts, for example sulphate of magnesium, separate from its solution the small quantity of camphor contained in aqua camphoræ. Coffee, the arterial sedatives, cold, and depressing causes generally, antagonize its physiological action.

Synergists.—All the remedies of this group, and alcohol, opium, and narcotic substances, increase the effects of camphor.

Physiological Actions.—Applied to the skin, camphor produces redness, heat, and superficial inflammation, if the contact be sufficiently prolonged ; to an open wound its effects are still more severe. Its taste is hot, aromatic, and pungent. In the stomach it causes a sensation of heat, and may excite in large doses inflammation and ulceration. The symptoms common to irritant poisons may, therefore, be produced by camphor. After experimental doses in animals camphor has been detected in the blood of the mesenteric and portal vein, but not in the chyle or urine. In moderate doses (medicinal) it increases the action of the heart, elevates the arterial tension, and promotes cutaneous transpiration ; it also produces mental exhilaration, even a gay and lively intoxication, and allays pain. In toxic doses, in addition to the local irritant action on the gastro-intestinal mucous membrane, and the consequent systemic effects, it lowers the pulse, the skin becomes pale, and the surface cold and moist, stupefies, diminishes the reflex functions of the spinal cord, and causes convulsions, insensibility, and death ; but these cerebral phenomena are not sepa-