

after delivery, and to relieve after-pains, but it is inferior to ergot for most of these purposes. It is serviceable in *subinvolution of the uterus*, and may be given in combination with ergot.

The aphrodisiac effects of *cimicifuga* render it useful in *spermatorrhœa*. It is not adapted to physiological spermatorrhœa, which is really a condition of normal plethora, but to those cases in which the organs are relaxed, the erections weak, and the seminal discharges feeble and occur on slight excitement.

To obtain curative effects from *cimicifuga*, it must be administered in sufficiently large doses to produce some of its cerebral effects.

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**Belladonna.**—Deadly nightshade.

*Belladonnæ Foliæ.*—Belladonna-leaves. The leaves of *Atropa belladonna* Linné (Nat. Ord. *Solanaceæ*), U. S. P. *Feuilles de belladone*, Fr.; *Tollkraut*, Ger.

*Belladonnæ Radix.*—Belladonna-root. The root of *Atropa belladonna*, as above. *Racine de belladone*, Fr.; *Belladonnawurzel*, Ger.

*Abstractum Belladonnæ.*—Abstract of belladonna. Dose, gr. ss—gr. j. Prepared from the root.

*Emplastrum Belladonnæ.*—Belladonna-plaster. (Belladonna-root and resin-plaster.)

*Extractum Belladonnæ.*—Extract of belladonna. Dose, gr.  $\frac{1}{4}$ —gr. j.

*Extractum Belladonnæ Alcoholicum.*—Alcoholic extract of belladonna. Dose, gr.  $\frac{1}{4}$ —gr. j. Prepared from the leaves.

*Extractum Belladonnæ Fluidum.*—Fluid extract of belladonna. Dose, ℥ j—℥ v. Prepared from the root.

*Tinctura Belladonnæ.*—Tincture of belladonna. Prepared from the leaves. Dose, ℥ v—3 ss.

COMPOSITION.—Belladonna contains a peculiar alkaloid, *atropine*, on the presence of which the physiological activity of the drug depends. This principle is found chiefly in the bark of the root, and of young root. Another principle has also been discovered analogous to atropine, to which the name *belladonnine* has been given. Ladenburg has shown that *belladonnine* is identical with the active principle of *hyoscyamus*, or *hyoscyamine*. It is identical with atropine in composition, and can only differ in the arrangement of its molecules. The root also contains a fluorescent substance and a coloring matter, which

has been called *atrosin*. Atropine exists in the plant in combination with malic acid as *bimalate*.

**Atropina.**—Atropine. Is in yellowish-white, silky, prismatic crystals, without smell, but having a bitter and acrid taste. It is soluble in three hundred parts of water at 60° Fahr., in twenty-five parts of ether, and in much less alcohol. It has a strong alkaline reaction, and forms crystallizable salts with acids.

*Atropinæ Sulphas.*—Sulphate of atropine. Is a white, slightly crystalline powder, very soluble in water and in alcohol, insoluble in ether, and wholly dissipated by heat. Dose, gr.  $\frac{1}{120}$ —gr.  $\frac{1}{60}$ .

ANTAGONISTS AND INCOMPATIBLES.—Caustic alkalies act on atropine, and ammonia is evolved; they are, therefore, incompatible with the preparations of belladonna. As respects physiological antagonism, physostigma and pilocarpus counterbalance the actions of belladonna in almost the whole range of its influence. Opium—within certain limitations to be hereinafter described—antagonizes the actions of belladonna. In cases of poisoning, the stomach should be promptly emptied by emetics (sulphates of zinc or copper), and the nervous disturbances combated, as they arise, by physostigma, opium, or pilocarpus.

PHYSIOLOGICAL ACTIONS.—Dryness of the mucous membrane of the nose, mouth, throat, and larynx, is produced by the direct application of atropine to these parts, and the same effects in a more positive manner follow the stomach or subcutaneous administration. A peculiar bluish appearance of the lips, as well as dryness, the author has frequently observed. Nausea is occasionally produced by belladonna, but this effect is probably due to cerebral disturbance. Dryness of the mucous membrane of the stomach and intestines is doubtless produced by belladonna, but increased secretion occurs subsequently, for the stools are rendered more liquid, and are also voided more frequently. Increased peristalsis is most probably a result of the action of belladonna on the unstriped muscular fiber of the intestines.

The active principle of belladonna (atropine) is an extremely diffusible substance. What changes it induces in the blood, if any, are not known. It affects the circulation in a remarkable manner. In some subjects a decided slowing of the heart takes place immediately after the administration of a considerable dose (atropine hypodermatically), and in all, most probably, an instantaneous retardation of the pulse-rate, but a very decided rise in the number of pulsations quickly follows. Not only is the number of the heart-beats increased, but their vigor also, and the area over which the pulsations are distributed is enlarged. It has been conclusively shown that the increased action of the heart is due, first, to stimulation of the cardiac ganglia of the sympathetic, and, secondly, to a paralyzing action on the pneumogas-

tric terminal filaments. In other words, the motor power of the heart is increased in activity, and the inhibiting control is lessened.

The stimulation of the vaso-motor centers by belladonna, or atropine, is not confined to the cardiac ganglia, but extends to the vaso-motor ganglia throughout the body, and a general rise of blood-pressure takes place owing to a contraction of the arterioles. It is a singular fact that the influence of atropine rapidly produces a state of over-excitation, and the irritability of the vaso-motor nervous system, at first increased, soon diminishes; the action of the heart becomes weak, the vessels dilate, and the blood-pressure falls below the normal. In large medicinal doses this effect is easily seen, and, in lethal doses in animals, it may be most certainly demonstrated.

As regards the function of respiration, atropine increases the number and depth of the respiratory movements, but the increase is not in the same ratio as is the elevation of the pulse-beat. The more rapid action of the heart, the increased respiratory movements, the contraction of the arterioles, result in an increased supply of blood to the periphery, more rapid nutritive changes, and consequent elevation of temperature. The rise in temperature in man, from a full medicinal dose, is from  $\frac{1}{2}^{\circ}$  to  $1^{\circ}$  Fahr. This increased body-heat is not long maintained; with the fall in the blood-pressure (vaso-motor paresis), there ensues a diminution in temperature.

In persons of a light complexion, more especially in women, a full dose of atropine is frequently followed by a diffused redness of the skin, not unlike the rash of scarlatina, but wanting in the punctated character of this specific eruption. Redness of the fauces, and some difficulty of swallowing, owing to the dryness of the mucous membrane, occur at the same time, rendering the similitude to scarlet fever very striking. The flush of atropine succeeds to a marked but temporary pallor, which is the first effect, and is a symptom of the vaso-motor paresis which succeeds to the vaso-motor stimulation. The belladonna rash is sometimes followed by desquamation.

Dilatation of the pupil is a conspicuous effect of atropine. Whether dropped into the eye, introduced into the stomach, or injected under the skin, prompt and decided dilatation of the pupil follows. A much smaller quantity suffices to produce this effect, when applied directly to the eye. Paresis of the muscle of accommodation is caused by atropine, and this agent also lessens the intraocular pressure. It has been conclusively shown that atropine produces these remarkable effects by an action on the peripheral filaments of the nerves of the iris, and not on its muscular fibers; atropine paralyzes the oculo-motor nerve end-organs, and stimulates those of the sympathetic.

The cerebral effects of belladonna are very characteristic. Head-ache, vertigo, illusions, hallucinations, a busy delirium, sometimes somnolence, are produced by large doses. The vision is usually lost,

the pupils are dilated to the utmost, the eyes are brilliant and staring. Muscular weakness, inco-ordination, and complete motor paralysis occur; but sensation is not destroyed; although occupied with fancies and illusions, the patient may be indifferent to moderate irritation. The delirium which occurs has a peculiar character: it may be gay and laughing, or busy, the patient being incessantly occupied with a single object or idea; or it may be noisy and furious, the patient fighting and striking all who approach. In lethal doses convulsions may occur, or profound stupor may result after a period of delirious excitement.

The voluntary muscles are not affected by belladonna. The muscular paresis which results from the administration of this drug is due to its action on the motor nerves, but the excitability of these nerves is diminished only, and not wholly destroyed. Both the motor-nerve trunks and the end-organs are affected. The sensibility of the sensory nerves is also impaired, but is not diminished to the same extent as is that of the motor nerves.

Although the action of belladonna is so largely paralyzant, it is not exclusively so, and, under certain circumstances, a tetanic action very similar to that caused by strychnine is developed. In frogs, a day or two after the induction of paralysis by the subcutaneous injection of atropine, the tetanic state occurs. When this state is reached, although the frog lies perfectly limp and motionless if undisturbed, an irritation applied to the periphery will at once cause general tetanic rigidity and spasms. The author was the first to show that this condition of the nervous system is attained in frogs an hour or two after the conjoined administration of atropine and physostigma (*eserine*).

Atropine, by virtue of the greater than normal transmission of blood through the tissues, increases metamorphosis, and the results of this are represented in an increased elimination of the products of waste.

Atropine is eliminated chiefly by the urine, and the urine of an atropinized animal will dilate the pupil of another animal.

THERAPY.—In *mercurial ptyalism*, and the *ptyalism of the pregnant state*, a few drops (five to ten) of the tincture of belladonna, given every four to six hours, or a corresponding quantity of atropine, will cause the excessive secretion to diminish, and even dry up, and will thus relieve a very disagreeable symptom. *Gastralgia*, as well as the pain which accompanies *gastric ulcer*, is often happily relieved by atropine. ℞ Atropinæ sulphatis, gr. j; zinci sulphatis, ʒ ss; aquæ destil., ʒ j. M. Sig.: *From three to five drops twice or thrice a day.* A similar combination is very effective in *pyrosis*, *chronic gastric catarrh*, and *irritative dyspepsia*. Atropine is frequently effective in relieving the *vomiting of pregnancy*. ℞ Atropinæ sulphat., gr. ij; aquæ destil., ʒ j. M. Sig.: *Two drops in water before meals.* It is often more useful when applied to the rectum in the form of supposi-

tory. It sometimes gives great relief when applied to the epigastrium in chloroformic solution. ℞ Atropinæ, gr. v; chloroformi, ℥j. M. Sig.: *A piece of lint to be moistened with the solution and laid on the epigastrium.*

The extract of belladonna is a useful addition to purgatives, to diminish the harshness and at the same time to increase the effectiveness of their operation. Belladonna has the power to increase the peristaltic movements and to allay irregular or spasmodic movements. It is, therefore, used to overcome *habitual constipation*. A pill containing a half-grain of extract, taken at night, will sometimes succeed, but it is generally better to combine it as follows: ℞ Ext. belladonnæ, ext. nucis vomicæ, ext. physostigmatis, āā gr. iij. M. Ft. pil. no. vj. Sig.: *One at bed-hour.* An addition of a half-grain of aloine will, of course, increase the action of this pill, and may be added when there are great torpor and inaction of the intestines.

When, in affections of the gastro-intestinal apparatus, acids are indicated with atropine, they may be combined as follows: ℞ Acid. muriat. dil., ℥j; atropinæ, gr. ss. M. Sig.: *Five drops in water before meals.* Such a prescription is useful in *heart-burn, water-brash, etc.*

Harley advises the use of atropine as a *cardiac stimulant*; but the fact that this agent exhausts the irritability of the cardiac ganglia after a period of excitement requires discrimination in its use. Notwithstanding this objection, atropine may be given to counteract a sudden and temporary depression in the heart's action—as, for example, in the collapse of cholera, in which it has been employed successfully by the hypodermatic method.

Belladonna is a remedy of great efficacy in certain *acute inflammations* of the air-passages. No remedy gives such prompt and sustained relief in *acute nasal catarrh with profuse watery secretion*. To adults, the best method of administration consists in giving a first dose of five drops of the tincture, and repeating a drop or two drops every hour until atropinism is produced. This remedy is also very admirably adapted to the treatment of *ordinary sore-throat*. As a constant physiological action of belladonna is redness and dryness of the fauces, its therapeutical action, in sore-throat with increased secretion, is antipathic or substitutive; or, as it may be more scientifically expressed, the action of belladonna is the physiological antagonist of the disease-action. When there is much fever it is useful to combine aconite with belladonna. ℞ Tinct. aconiti rad., ℥j; tinct. belladonna, ℥ij. M. Sig.: *Four drops in water every hour or two.* That form of *aphonia* which is due to fatigue of the vocal cords may be removed very speedily by a morning and evening dose ( $\frac{1}{120}$ — $\frac{1}{80}$  of a grain) of atropine. Not unfrequently *hysterical aponia* may be quickly cured in the same way.

There is much to be expected from the use of belladonna preparations in *whooping-cough*. The best form for administration is a solution of the sulphate of atropine (gr. j—℥j of water. Dose, ℥ij—℥iv). This remedy is not adapted to all cases, and is most effective in the spasmodic stage. In order to be curative, physiological effects must be produced. The good results of atropine in whooping-cough are most obvious in those cases characterized by profuse bronchial secretion.

Belladonna gives great relief in paroxysms of *asthma*, and in the spasmodic difficulty of breathing which accompanies emphysema. According to the author's observation, when the bronchial mucous membrane is deficient in secretion, the pulse much accelerated, the skin dry and hot, belladonna rather adds to the distress; and its good effects are most conspicuous when there are abundant expectoration, a cool and moist skin, and a quiet pulse of low tension. In asthma, atropine may be injected subcutaneously, or the belladonna-leaves be used by the method of fumigation. Belladonna-leaves, dipped in a saturated solution of niter and then dried, may be burned in a close apartment, the patient breathing the fumes until relief is obtained. Pastiles are made of belladonna, stramonium, poppy, tobacco, etc. A good formula for cigarettes is the following (Trousseau): Belladonna, grs. v; stramonium and hyoscyamus, of each grs. iij; extract of opium,  $\frac{1}{4}$  of a grain; cherry-laurel water, a sufficient quantity. The leaves are moistened with a solution of the opium in the cherry-laurel water, and when dry made into a cigarette. Two to four of such cigarettes may be smoked daily. When the paroxysms of asthma occur in the morning, they may sometimes be prevented by the one sixtieth of a grain of atropine at bedtime.

The remarkable similarity in the symptoms of atropinism and of *scarlatina* has led to the use, by homœopathic practitioners, of belladonna as a *prophylactic against this disease*. The points of resemblance are so superficial, and the differences so wide, that no more striking instance could be adduced of the uncertainty in the application of the homœopathic dogma, even admitting its truth. The author is convinced that the so-called prophylactic power of belladonna against scarlatina has no real existence. He has seen too many cases of scarlatina occur in subjects who had been given the remedy freely, to permit him to come to any other conclusion. Belladonna is a useful remedy to relieve some of the symptoms in scarlatina. During the stage of eruption it is indicated when the pulse is feeble, the bodily powers are depressed, and the rash is imperfectly evolved. In this condition of things—in which carbonate of ammonia is so much used—belladonna also renders most important service; but it should not be forgotten that these agents are chemically incompatible, and should not, therefore, be prescribed together.

In *diphtheria*, when there is much depression, belladonna is a most excellent remedy. If given before the exudation has spread and consolidated into membranous plaques, and when a few patches only have appeared on the tonsils, or soft-palate, it seems to have the power to hinder the formation of the exudation.

There is no doubt that belladonna has a real curative power in *erysipelas*. It is especially adapted to *idiopathic erysipelas*, notably to *facial erysipelas*, and is less serviceable in traumatic *erysipelas*. Homœopaths explain this on the doctrine of similars, but the action is really one of antagonism, or substitution. When there is much fever, digitalis or aconite may be combined with belladonna with advantage, and when there is much depression, quinine. ℞ Quininæ sulph., ʒ ss; belladonnæ extract., grs. iij. M. Ft. pil. no. x. Sig.: *One every four or six hours.*

Excellent results have been obtained from the use of belladonna in *typhus and typhoid fevers*. Graves originally suggested an indication for its use in fevers, which is doubtless serviceable, viz., contracted pupils; but belladonna has been used, irrespective of this sign, by other practitioners with great success. The tincture is a suitable preparation, and of this from five to ten drops every four hours is a proper dose. According to the author's observation, belladonna is indicated when there is much low, muttering delirium, subsultus, and stupor, and is contraindicated in the condition of delirium ferox.

Belladonna has important application in the treatment of certain disorders of the nervous system. *Sick-headache*, due to or accompanied by spasm of the arterioles—a condition manifested by pallor of the face, vertigo, and *tinnitus aurium*—is relieved by belladonna. At first the distress may be even increased, but great relief presently follows. This remedy is injurious in the congestive form of sick-headache. The following is a serviceable combination in the cases of sick-headache due to vaso-motor spasm: ℞ Atropinæ sulph., gr. ss; chinoidin, ʒ j. M. Ft. pil. no. lx. Sig.: *One pill twice or thrice a day.*

Although belladonna in the physiological state induces wakefulness and busy delirium, in certain morbid states of the brain it is *hypnotic*. The indications for its use are as follows: prostration, low state of the arterial tension, languid intra-cranial circulation, a contracted pupil, and insomnia, due to the condition of the brain manifested by these objective signs. In various kinds of *mental disorder*, in which the foregoing symptoms are present, much good may be expected from the use of belladonna in moderate doses; but harm only will be produced by it when there is much vascular excitement.

Belladonna, according to Trousseau and Pidoux, is a more efficient remedy in the treatment of *epilepsy* than the salts of silver, copper, or zinc. They insist that the capital condition of success is perseverance

on the part of the physician and patient, that belladonna should be given steadily for a year in gradually-increasing doses, and that if amendment is then produced it should be continued through two, three, or even four years. Belladonna is not equal to bromide of potassium in cases of diurnal epilepsy, in epilepsy accompanied by cerebral hyperæmia, and in epileptiform convulsions due to coarse organic lesion of the brain. The best results are obtained from it in nocturnal epilepsy, in *petit mal*, and in pale, delicate, and anæmic subjects, with cold hands and feet, blue skin, and weak heart.

In *neuralgia* belladonna affords relief, although not equal to some other agents. Given *hypodermatically* (see post), it is often very effective. In any case, its use must be persisted in; full doses are necessary, and physiological effects must be produced and maintained for some time. A solution of atropine is the best form for the stomach administration. *Dysmenorrhœa*, when neuralgic in character, and *ovarian neuralgia*, may be permanently removed by belladonna. It is useful in these cases to combine it with synergistic remedies. ℞ Ext. belladonnæ, grs. iv; ext. stramonii, grs. v; ext. hyoscyami, grs. v; quininæ sulphat., ʒ ij. M. Ft. pil. no. xx. Sig.: *One pill two or three times a day.* When anæmia exists, iron may be added to this formula.

No single agent has been as uniformly successful in the treatment of *nocturnal incontinence of urine* as belladonna. This morbid state is due to several conditions, and belladonna is not equally successful in all: nocturnal incontinence may be due to an excess in the acidity of the urine, which renders it unduly stimulating; to relaxation of the sphincter vesicæ; to an irritability of the mucous membrane, in consequence of which erroneous impressions are communicated to the brain. Belladonna gives relief in the two last-named conditions. The atropine dissolved in the urine acts locally on the nerves of the mucous membrane, diminishing their irritability; the sphincter is put into a state of tonic contraction by reason of the systemic effect, which includes, of course, the sympathetic system. The error is often committed of giving too little of the remedy; systemic effects must be produced, and children, compared with adults, are insusceptible to the action of belladonna. The best form for administration, because less disagreeable and more constant in effect, is a solution of atropine.

*Nocturnal seminal losses*, as respects mechanism of production, making allowance, of course, for difference of seat, have a strong analogy with nocturnal incontinence of urine. This trouble may be considered a morbid state, only, when the losses are frequent and affect the health. Bromide of potassium best relieves spermatorrhœa, so called, when it is largely physiological and due to a normal plethora; belladonna is most serviceable when the genitalia are relaxed, the

emissions flowing without force, and without a distinct dream and orgasm.

Atropine is a remedy of the greatest importance in the *practice of ophthalmology*. As it dilates the pupil, diminishes the intraocular pressure, contracts the arterioles, and acts topically on the sentient nerves, it is obvious that its field of utility is wide, and its therapeutic power great.

In *phlyctenular keratitis* atropine renders the greatest service; it diminishes the photophobia and blepharospasm, and lessens the blood-supply by contracting the vessels. It has a still more beneficial action in *iritis*; it prevents adhesions, anterior and posterior, and by dilatation of the pupil so compresses the vessels as to jugulate the inflammatory process. When the cornea is perforated, herniary protrusion and adhesion of the iris are prevented by dilating the pupil. For these purposes a four-grain solution of atropine is the proper strength for instillation into the eye. When it is desirable to suspend the power of accommodation, in cases of *hypermetropia* to determine the refraction of the eye, and in *astigmatism* to ascertain the difference in the meridians, atropine is used. A weak solution only is employed, to dilate the pupil for a brief period, in order to facilitate the examination of the fundus of the eye. Dilatation of the pupil with atropine is also necessary in the examination of *cataract*, especially in the early stages of its formation. It should be remembered that strong solutions of atropine instilled into the eyes may, by subsequent absorption, produce atropinism, and to such an extent as to occasion solicitude.

In certain *affections of the skin* belladonna is useful—viz., in the *cutaneous neuroses, prurigo, herpes zoster, erythema, and eczema*, etc. Cases of these affections which resist ordinary treatment, yield to belladonna. The tincture, or the alkaloid, in suitable doses, may be given in quantity sufficient to maintain a slight physiological action. *Hyperidrosis* (colliquative sweating), *unilateral sweating*, and other forms of profuse transpiration through the skin, are arrested by the internal and, in some cases, by the local application of the belladonna preparations, as Ringer has shown.

No remedy is so generally effective in relieving the *sweats of phthisis* as atropine. The one sixtieth of a grain at bedtime usually suffices. The author was the first to indicate this use of atropine in his "Prize Essay." Not only is atropine antagonistic in action to that condition of the sudoriparous glands resulting in the sweats of disease, but it equally antagonizes the hyperidrosis produced by such drugs as jaborandi.

In the treatment of that form of phthisis known as *caseous pneumonia*, atropine has an important place, quite irrespective of its power to arrest the sweats. As Dr. Fothergill, of London, and myself, nearly simultaneously ascertained, it has an influence on the progress of these

cases, and a curative effect that is often very remarkable. The author has observed with regret that some of those who have found this remedy useless, were entirely mistaken as to the character of the cases in which atropine has proved beneficial. As a remedy for the caseous inflammation, without regard to sweating, the period when the degree of benefit above referred to may be expected from it, is the stage of deposit immediately succeeding the stage of catarrhal inflammation, and before softening and extrusion.

**HYPODERMATIC USE OF ATROPINE.**—The solution usually employed for this purpose is two grains of the sulphate of atropine to an ounce of distilled water, the dose of which ranges from two to five minims.

There are two forms of *neuralgia* in which the subcutaneous use of atropine has been most signally useful: *tic-douloureux* and *sciatica*, more especially the latter. Atropine is not as effective in the treatment of the neuralgias in general as morphine, and the systemic effects of the former are much more unpleasant than those caused by the latter. Nevertheless, when morphine fails or disagrees with the patient, atropine may be used with confident expectation of its affording relief. We owe to Hunter our knowledge of the fact that atropine has a very special utility in *tic-douloureux* and *sciatica*. The merely subcutaneous injection of atropine does not afford the same degree of relief as its deep injection in the neighborhood of the affected nerve-trunk. Furthermore, a decided impression must be made on the cerebrum, in order to obtain the best results. The largest doses compatible with the safety of the patient must be used—generally the one fiftieth of a grain to the one thirtieth. If the remedy is employed in sufficient quantity, and well inserted into the tissues above the nerve, decided curative results may be expected from it in these two forms of neuralgia. When relief follows the injection of atropine, it is apt to be more permanent than when the same degree of relief is obtained from morphine. We have the high authority of Dr. Anstie for the assertion that atropine is exceptionally serviceable in *peri-uterine* and *dysmenorrhœal neuralgia*. Dr. Weir Mitchell asserts that atropine in *traumatic neuralgias* is "simply useless," and, as his power of accurate observation is unquestioned, and his clinical opportunities vast, we may accept this conclusion as final.

*Muscular cramp, from injuries to the nerve-trunk*, are often remarkably relieved by injections of atropine into the substance of the affected muscles. The so-called "late rigidity," as the result of which the members may be put into very injurious positions, is occasionally removed or diminished by the same expedient—viz., injecting a small quantity of atropine ( $\frac{1}{15}$  of a grain) into the contracted muscles. This result does not ameliorate the condition of the patient to any greater extent than that of affording relief to an inconvenient deformity.

The *insomnia of mental disorders*, and of *delirium tremens*, may be overcome by the hypodermatic injection of atropine when the following indications for its use are present: Coma vigil, great restlessness, weak action of the heart, coldness of the surface, cyanosis, clammy sweat. When there is a condition of hyperæmia of the cerebro-spinal centers, excitement with elevated pulse-rate and increase of arterial tension, atropine can only do harm.

The treatment of *asthma* by belladonna, administered by the stomach and in the form of fumigation, has already been referred to. The hypodermatic injection of atropine is much more effective. From  $\frac{1}{120}$  to  $\frac{1}{60}$  of a grain may be used for this purpose; but, as the relief comes from the systemic effect, it is not necessary to inject the solution in the neighborhood of the pneumogastric, as practiced by Courty. In order to procure the greatest relief, the injection should be made at the beginning of the asthmatic paroxysm, and succeeding attacks should be anticipated by inducing atropinism at the first warning of a seizure.

*Vomiting of pregnancy*, when obstinate and resisting other means, is sometimes arrested promptly and permanently by the subcutaneous injection of atropine in small quantity ( $\frac{1}{120}$  of a grain). *Sea-sickness* is relieved in the same way. In these maladies, it is better to insert the injection in the epigastrium.

Cramp of the hollow muscular organs—*hepatic, intestinal, uterine, and renal colic*—may all be relieved by the subcutaneous injection of atropine, but the most satisfactory results are produced by the combined use of atropine and morphine.

EXTERNAL APPLICATION OF BELLADONNA PREPARATIONS.—The chloroformic solution of atropine is an excellent external application to relieve pain in nerves superficially situated. ℞ Chloroformi, spts. vini rect., aa ʒ ss; atropinæ, grs. v. M. Sig.: *Apply on lint to painful part, and cover with oiled silk.* The same application to the epigastrium sometimes arrests *obstinate vomiting*, cerebral or reflex, as, for example, the *vomiting of pregnancy, sea-sickness*, etc. A belladonna-plaster is an excellent application to relieve the *chest-pains of phthisis, to allay irritability of an over-excited heart*, to diminish the pains and soreness of *lumbago, myalgia*, etc.

*Excessive sweating* of a part, as, for example, *unilateral sweating of the head*, may be removed by brushing over the affected surface a solution of atropine (grs. iv—ʒ j).

There is no doubt that belladonna has the power to arrest the secretion of milk, in the same way that it stops the cutaneous transpiration, for the milk-gland is only an enlarged sebaceous gland whose function is differentiated from that of other sebaceous glands of the body. When it is desirable to *arrest the secretion of milk*, the gland may be enveloped by a belladonna-plaster, or the ointment of belladonna may be carefully rubbed into the integument. These are rather

disagreeable, sticky applications, which soil the clothing. A much more elegant method of applying this treatment is to envelop the breast in lint wet with a solution of atropine, four grains to the ounce of rose-water. As systemic effects may be produced by such an application, when the pupils dilate and the mouth becomes dry, it should be removed. *Inflamed breasts* may be treated in the same way. The mode of action of the belladonna preparations is quite obvious: the irritability of the terminal filaments of the nerves is allayed by the direct action of the atropine, and the arterioles are made to contract, thus diminishing the blood-supply to the inflamed tissue.

Other superficial inflammations are subdued by the same treatment, as, for example, *abscesses, boils, carbuncles*. A plaster made of belladonna extract may be kept in contact with the inflamed tissue, or the solution of atropine, above recommended, may be used.

*Pruritus of the vulva, vaginismus, fissure of the anus*, are sometimes relieved, as if by magic, by the use of the atropine solution above recommended.

Whenever atropine is used locally for the relief of inflammatory pain and swelling, the efficiency of the application is much increased by the addition of morphine, or morphine and chloral, according to formulæ to be given hereafter in the article on the latter drug.

SECONDARY PRODUCTS OF ATROPINE.—Some remarkable products have lately been obtained from atropine by chemical processes. The first step consisted in the discovery, by Kraut and Lossen, simultaneously, that atropine may be split up into *tropine* and *tropic acid*. Subsequently, Prof. Ladenburg succeeded in the synthesis of atropine by a combination of these two secondary products. If the salts of tropine are treated with dilute hydrochloric acid, alkaloids are produced, to which Ladenburg has given the name *tropeins*. *Homotropine* is an alkaloid obtained from the amygdalate of tropine. The artificial atropine, prepared as above described, has precisely the same effects as the original alkaloid.

*Effects of Homotropine*.—The preparation of this base now used is the hydrobromate. The physiological action of this new salt has been studied by Ringer and Tweedy, among others. Ringer finds that, like atropine, homotropine paralyzes and tetanizes, but the tetanizing effect, which follows in forty-eight hours or more in the former, occurs at once in the latter. The paralyzing action is not in the nerves or muscles, for they respond to electrical stimulation, but in the cord, which is also the case with atropine. Homotropine, like atropine, increases the action of the heart by paralyzing the intra-cardiac inhibitory apparatus, and it also antagonizes muscarine. In man there is a marked distinction as regards the action of atropine and homotropine on the heart: while the former accelerates the heart considerably, the latter retards the beat from ten to twenty per minute, and also makes

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.  $\frac{1}{4}$ —gr. ss.

*Tinctura Stramonii.*—Tincture of stramonium. Dose,  $\mathfrak{m}$  v— $\mathfrak{z}$  ss.

*Extractum Stramonii Fluidum.*—Fluid extract of stramonium. Dose,  $\mathfrak{m}$  j— $\mathfrak{m}$  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 com-

ination 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 functioning 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.  $\frac{1}{4}$ —gr. j.

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

*Extractum Hyoscyami Fluidum.*—Fluid extract of hyoscyamus. Dose,  $\mathfrak{m}$  v— $\mathfrak{z}$  ss.

*Tinctura Hyoscyami.*—Tincture of hyoscyamus. Dose,  $\mathfrak{z}$  ss— $\mathfrak{z}$  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