for this. The great object is to produce as quickly as possible, and then to maintain, the physiological effect of physostigma in diminishing reflex excitability. The doses must, therefore, be continued in increasing quantities until this physiological effect is produced, or until the sedative action of the drug on the circulation is carried to a dangerous extreme, or until constant nausea and vomiting compel us to desist.

"This nausea is, I believe, due to the action of physostigma in causing energetic contractions of the stomach and intestines. To this cause may also be referred a peculiar epigastric sensation, which is one of the first symptoms of the action of this drug, whether it be administered by the stomach or subcutaneously, and which is always relieved by eructation. The catharsis that physostigma causes—probably an advantageous effect in tetanus—is another result of this intestinal contraction, though it is also due to an increase of secretion by the intestinal glands.

"Another physiological effect of physostigma is excessive perspiration. This is most strikingly observed when a large dose is administered by subcutaneous injection. It may be of some importance in the treatment of tetanus, for sudorifics are vaunted as reliable remedies for this disease; but as I am at a loss to understand why perspiration should in itself prove beneficial, I mention it only as an indication that physostigma is affecting the system.

"It might reasonably be expected that the active principle of physostigma—eseria—should be valuable in tetanus, and especially for administration by subcutaneous injection. It is, however, an alkaloid that is very difficult to prepare, and as far as my knowledge of its properties is concerned, it appears to be somewhat unstable. There is, besides, but little advantage in employing a more active remedy than the extract of physostigma.

"In these observations, no distinction has been drawn between the traumatic and idiopathic varieties of tetanus. As far as treatment is concerned, they only differ in this, that the traumatic variety is usually the more severe and acute, and

that it therefore generally demands a very energetic and active employment of the remedy."

Dr. Fraser next makes a few remarks on the influence of this remedy over chorea, but at present there appears to be little evidence on this subject. "The treatment of this disease," he says, "will rarely require to be so active or energetic as that recommended for tetanus. Physostigma should be administered either in the form of powder or of tincture. From three to six grains of powder, three or four times daily, may be given to children, and from ten to twenty grains, as frequently to adults."

Dr. Crichton Browne finds Calabar bean markedly useful in general paralysis of the insane; indeed, he has discharged some of his patients cured of this severe disease. I have known it arrest the progress of this disease, and even slightly improve the mental and physical condition. I have seen it not only arrest progressive muscular wasting, uncomplicated with much mental disorder, but also effect considerable improvement in the muscular power. Moreover, it has appeared to me to effect some good in cases of long standing hemiplegia. I have given the extract of physostigma in one-thirtieth of a grain doses every two hours.

THERAPEUTICS OF BELLADONNA.

Certain animals, like pigeons and rabbits, appear to be almost insusceptible to the influence of belladonna. Dr. Horatio Wood has shown that, locally applied, belladonna does not dilate the pupil of pigeons, which confirms Wharton Jones's observation that neither does it when administered internally. Not only belladonna, but also stramonium and hyoscyamus, have very little action on pigeons, it being almost impossible to kill them with these substances. Two grains of atropia administered hypodermically, are required to kill a pigeon,

and Calmus found that fifteen grains are required to kill a rabbit. It is said that all vegetable feeders are but little affected by belladonna, whilst it is a powerful poison for flesh eaters. Thus, it is asserted that belladonna has very little effect on horses and donkeys.

The preparations of belladonna are of frequent and great use as external applications; no applications are so effective for the relief of pleurodynia and the hyper-sensitiveness of the skin and irritability of the muscles of the chest in phthisis, as the liniment or plaster of belladonna. The liniment, both as the stronger and cleanlier preparation, is preferable to the plaster, and should be rubbed over the tender and painful part several times daily, according to the severity of the pain. Although as a rule the liniment is preferable, yet in certain cases of pleurodynia the constant application of the plaster gives more relief. The liniment of belladonna, or the ointment of its alkaloid, is sometimes used in facial neuralgia.

Myalgia, so admirably described by Dr. Inman, often yields to belladonna, although opium preparations, as the linimentum saponis cum opio, sometimes succeed better.

An attack of lumbago, affecting perhaps the whole loins, often leaves behind it one painful spot, which may distress the patient only when the body is moved in one direction. Remains of a lumbago like this generally resist the usual methods of treatment, and are perhaps, driven from one spot only to reappear at another; but a large belladonna plaster will generally lessen, if it fail, altogether to remove these pains.

Belladonna employed either internally or externally checks or even suppresses the secretion of the glands. This at least is true of the mammary, sudoriparous and salivary glands, and possibly of other glands. It is well known that belladonna applied to the breast will arrest the secretion of milk, and is employed with great advantage when, from any cause, a mother with abundance of milk is yet unable to suckle her child, and the breasts become much swollen, exquisitely painful, and threaten to inflame and suppurate, unless the tension

of the ducts is relieved either by the removal or suppression of the milk. If the milk cannot be drawn off artificially the secretion must be suppressed, which can be easily affected by belladonna. It should be applied early, before inflammation has set in, and then in a few hours the swollen, painful breast gradually diminishes, and soon becomes soft, comfortable, and painless. But should this early stage have passed by, and inflammation have set in, and the breasts become tense, shiny, hard, knotty, red, and exquisitely painful, the continuous application of belladonna for twenty-four or forty-eight hours will, even under these adverse circumstances, often remove the tension and inflammation, and arrest impending abscess. The rapid manner in which it affords relief in these cases will greatly astonish any one unaccustomed to its use; in fact, it is impossible to overstate the usefulness of belladonna. It should be employed in all cases, no matter how far the inflammation has advanced. In many instances it will arrest an abscess otherwise almost certain to maturate. Even when it fails to prevent suppuration, yet the application of belladonna will reduce inflammation, subdue much of the pain, and greatly limit the inevitable abscess.

The liniment, the extract, the ointment, or a drachm of the tincture to an ounce of olive oil, or two drachms of the liniment mixed with an ounce of lard, may be used. The liniment is speedily effectual. These applications should be rubbed especially over the areola around the nipple.

Frequent fomentation with very hot water, unless cooler water should be found more agreeable and soothing, is an excellent adjunct to these applications. The nurse must be cautioned to wipe the skin perfectly dry after fomenting, or the friction with the liniment will irritate the skin, and produce a sore.

Belladonna will arrest not only the secretion of milk, but the secretion of the perspiration. A man forty-five years old had been troubled for many months with very profuse sweating of the right side of the face and neck, breaking out on the slightest exertion, or when near a fire, or if excited, so

that the sweat ran down his face and neck in streams, soaking his collar and the band of his shirt, his face being neither red nor injected. The perspiration produced an abundant crop of miliary vesicles, which were strictly limited to one half his face. The liniment of belladonna applied two or three times a day abated this abundant sweating considerably and reduced it to little more than the natural amount.

The effect of belladonna in this instance led the writer to test its influence over other kinds of sweating. The liniment of belladonna, used twice or three times a day, will completely check the sweating about the head and face of young children often so profuse as to soak their hair and the pillow upon which they have been sleeping. After a few days the application may be discontinued without a return of the perspiration. Again, many adults, even when in health, during all their lives, are troubled with profuse sweating of the hands or feet; sometimes so copious as to run off them in drops, and especially noticeable at the tips of the fingers and the ball of the thumb. The belladonna liniment, rubbed into the hands or feet three or four times a day, will often gradually diminish and sometimes arrest this annoying affection completely, although, no doubt, in some cases the treatment fails. Sometimes the good effects are permanent, or the sweating may not return for a considerable time.

Since the foregoing remarks were published the author has made many fresh observations confirming the efficacy of belladonna to check sweating. Thus, to a patient, who all her life had suffered from profuse sweating of the left side of the body, was ordered a belladonna ointment to be rubbed into the face twice or three times a day with the effect of completely checking the excessive sweating of the whole left side. Again, the author has met with cases of local sweating over a surface a little larger than the hand, over the loins, the perspiration exciting a copious eruption of eczema. In this case belladonna checked the perspiration, and thus cured also the eczema.

Many experiments of the following kind were instituted.

On several occasions a patient, after undergoing a sweating in the hot air bath, was rubbed on one side of the face for a quarter of an hour three times a day for two or three days with belladonna ointment; then the bath was repeated of the same temperature and duration, when it was observed that the sweating both during and subsequent to the bath was very greatly lessened; and that the effect was general, although the ointment was applied only to one side of the face. In some cases the ointment was rubbed into the chest, but then the effects were much less marked than when applied to the face, possibly because less of the ointment was absorbed.

As the local application checked sweating over the whole body it was concluded that it acted by its absorption, and this led to the internal administration of belladonna, but its repressing effect was apparently decidedly less than when locally applied, possibly because less of the drug was given by the mouth than was absorbed by the skin. Still no doubt the internal administration of belladonna does sometimes effectually control sweating, as the author has often witnessed in the case of weakly children perspiring profusely on exertion and whilst sleeping; and in the curious case of a middle-aged man, who after much mental worry suffered from excessive sweating of both cheeks while eating, especially hot meat or vinegar, the sweating ceasing immediately after the meal. This man passed at times a profuse quantity of pale urine. Ten drops of tincture of belladonna, thrice daily, checked completely the sweating.

Employed hypodermically, atropia promptly checks sweating. After repeated experiments, I find that in profuse sweating, produced by the hot chamber of the Turkish bath, one one-hundredth or one two-hundredth of a grain of atropia, will, in a few seconds, completely dry the skin and maintain it dry, notwithstanding the continuance of the bath. These experiments led me to employ belladonna hypodermically in the sweating of phthisis and other exhausting diseases, and I found that one one-hundredth or even one two-hundredth of a grain would generally arrest the sweating, sometimes for

more than one night; and that it also made the patient sleep better, and quieted cough in phthisis. Mr. William Murrell has recently made sixty experiments on phthisical patients, and finds that the drug fails in about from 8 to 10 per cent. It was equally successful with men and women, in febrile and non-febrile cases, in the prostrate and comparatively strong. Sometimes its effects are delayed; thus, if administered at bedtime, it may not check sweating till the following night. The beneficial influence may extend over several nights, then gradually wear off, so that each night the perspiration returns a little earlier. In a few cases it permanently checks the perspiration. This treatment unfortunately produces disagreeable dryness of the throat; but as many phthisical patients suffer in this way, the slight increase of it induced by atropia is scarcely noticeable.

Belladonna checks the secretion of that abundant foul-smelling sweat from the feet. Eau de Cologne may be used instead of simple spirit in making the liniment, thus forming an agreeable-smelling application. It has been experimentally proved, that in the cases just described, the effects are due to the belladonna and not to the spirit.

In checking sweating about the head and face, too much liniment should not be applied at one time, or, becoming absorbed, it will dilate the pupil and obscure the sight.

Belladonna will also arrest the salivary secretion, and thus induce dryness of the mouth. Its influence on the secretion of the sub-maxillary glands has been fully worked out. This gland receives branches from the chorda tympani nerve which is endowed with two sets of fibres, one acting immediately on the cells, the other causing the blood-vessels to dilate, being vaso-inhibitory. Belladonna acts through the nerves distributed to the cells, for after the injection of atropia, if the chorda tympani nerve is irritated, the vessels of the sub-maxillary gland become distended as usual, but the gland does not secrete. The paralysing effect of atropia is antidoted by physostigma, for after the injection of physostigma, irritation of the chorda tympani causes the gland to secrete.

Dr. Cook recently cured salivation from mercury, and scurvy, by the hypodermic injection of atropia.

Remembering that in acne there is over-abundant secretion from the sebaceous follicle, the writer was induced to use belladonna with the hope of checking it, and this treatment appeared to be of some slight service.

While speaking of milk abscesses, it was stated that, apart from its power to arrest the milk secretion, belladonna will, in some measure, subdue inflammation and its accompanying pain. Belladonna too is effectual in other forms of inflammation threatening perhaps to end in abscess. Mr. Christopher Heath has shown that belladonna will prevent the formation of abscesses in the neck and elsewhere, and after the onset of suppuration will check the pain and inflammation. The belladonna treatment of boils and carbuncles often succeeds.

Belladonna preparations are of further use as local applications. Thus, the extract smeared over the painful cracks in the mucous membrane, is employed to relieve the pain of fissure of the anus.*

The extract in conjunction with tannin, in the proportion of one or two grains of extract to six or eight of tannin, is recommended by Trousseau, in leucorrhœa with ulceration of the os uteri, and in neuralgia of the uterus. The belladonna arrests the too abundant secretion from the mucous glands on which leucorrhœa depends, while its action in this respect is assisted by the tannin. In both affections the belladonna is very efficient in relieving pain. The mixture of belladonna and tannin may be wrapped in cotton-wool, or made into a bolus with cocoa-nut fat, and placed in contact with the painful and over-secreting os. Some obstinate forms of leucorrhœa yield completely to this treatment.

When the disease depends on too free a secretion of the mucous glands about the os uteri, and when this condition is accompanied by much pain, the following injection yields

* M. Maisonneuve employs forcible distension of the rectum in these cases with considerable success. By forcing two or more fingers up the rectum he overcomes the spasm and gives permanent relief.

good results :—bicarbonate of soda, a drachm; tr. of belladonna, two ounces; water, a pint. The syringe should be introduced as far as possible, while the patient lies on her back, with her buttocks raised by a pillow; then one or two syringefuls used cold, should be injected into the vagina, and made to reach the mouth of the uterus. This position should be maintained for a few minutes, so as to allow the wash to remain in contact with the os uteri for a few minutes.

Dr. Anstie has recently recommended atropia in hypodermic injection, to relieve local pain and spasm. He vouches for its great efficacy,—"it should be employed in the form of solution of the sulphate, four minims containing one-sixtieth part of a grain, two minims will be the proper commencing dose in adults, unless the pain to be relieved be very severe. It should be cautiously increased to one-sixtieth or one-fiftieth part of a grain, more can seldom be needed." He further states, "it is somewhat less frequently tolerated than morphia, but persons quite unable to bear morphia will often bear atropine, and *vice versa*." He agrees with Hunter that when this drug does succeed its effects are more permanent than those produced by the hypodermic injection of morphia. Dr. Anstie has employed atropia hypodermically, with great benefit in one case of asthma, and in two of glaucoma. The same treatment is sometimes useful in neuralgia and sciatica, although the pain of these affections is generally subdued more easily by morphia.

Dropped into the eye, applied to the skin in its neighbourhood, or taken by the stomach, preparations of belladonna very speedily produce extreme dilatation of the pupil. This is one of the most characteristic effects of belladonna. In iritis and some other eye diseases, solutions of atropia are used to produce dilatation of the pupil, and to prepare the eye for an ophthalmoscopic examination. Belladonna is employed both locally and internally in conjunctivitis and other inflammations of the eye.

The local application of the liniment or ointment of belladonna will often relieve and sometimes cure neuralgia,

especially of the fifth nerve, as of the brow or under the eye, severe pains in the eye-ball, with intolerance of light, and even sciatica.

A full dose of belladonna produces great dryness of the tongue and roof of the mouth, extending down the pharynx and larynx, inducing consequently some difficulty in swallowing, with hoarseness, and even dry cough; and a large dose will sometimes induce dryness of the Schneidarian membrane, and dryness of the conjunctiva, with much injection.

"After about two hours," says Dr. J. Harley, "the dryness of the mouth gives way, to be replaced by a viscid, sticky, acid, and foul-smelling secretion, and the mucous membrane becomes clammy, and the tongue is covered with a white fur." Harley produced ophthalmia in a dog by belladonna. Many of these symptoms indicate the influence of belladonna in arresting secretion.

In several instances Harley has seen belladonna clean and moisten the tongue of typhus-fever patients. This remedy is employed in several inflammatory diseases of the throat, and its good effects are most apparent when the throat and tonsils are acutely inflamed and much swollen. It may be given in combination with aconite, and the influence of aconite on this form of inflamed throat, provided the pulse is full, and the skin hot and dry, is greater than that of belladonna.

The influence of belladonna on digestion is not known.

The tincture may afford relief in some painful affections of the stomach—a very vague statement, but as exact as our present knowledge of the drug will permit. The author has heard it praised in "gout of the stomach." In doses of twenty or thirty minims, administered every three or four hours, the tincture has arrested obstinate forms of the vomiting of pregnancy.

It is not ascertained in what way this medicine affects the intestines; but, bearing in mind its influence on the lining membrane of the mouth, it may be conjectured that belladonna lessens the secretion of the intestinal canal. It has been asserted, but without adequate proof, that belladonna increases the peristaltic movement of this canal.

Trousseau recommended belladonna in obstinate constipation, and no doubt it succeeds admirably in many instances. He advised doses of, from one-sixth to one-fourth of a grain of the extract to be taken once a day, either night or morning, increasing gradually the dose; diminishing or discontinuing the medicine when the constipation is removed. Dr. Nunneley finds this treatment useful in all forms of constipation, especially when co-existing with dyspepsia, characterized by a thinly furred tongue, with prominent red papillæ at the tip, epigastric tenderness, pain after food, and often more or less headache. It ensures a natural evacuation daily. It must be continued a fortnight or three weeks. Mr. Foster of Huntingdon, tells me that a small dose of belladonna prevents the constipating effects of iron. In some of the severest cases of constipation where powerful purgatives had failed, a suppository of one or two grains of the extract has opened the bowels.

Belladonna often relieves colic of the intestines; and is especially serviceable in the colic of children.

That the active principle of belladonna is readily absorbed into the blood, is proved by the symptoms. After a considerable dose of belladonna the face becomes much flushed, the eye bright, dry, and injected, the pupil dilated, the sight dim and hazy, while the power of accommodation in the eye for distance is lost. The mind and senses are peculiarly affected. The ideas, at first rapid and connected, become incoherent and extravagant; there is often decided delirium, with pleasing illusions. Sometimes the patient is possessed with constant restlessness, keeps continually moving, and cannot be quieted. A kind of somnambulism is occasionally observed; thus cases are recorded where, under the influence of belladonna, the patient for a long time performs the movements customary to his occupation; thus, it is narrated of a tailor that he sat for hours moving his hands and arms as if sewing, and his lips as if talking, but without uttering a word.

The delirium may be furious and dangerous, requiring the patient to be restrained; nay, it is recorded of one poisoned

by this drug, that so violent did he become that he was ordered to be confined in a mad-house. Sometimes a very small dose will induce this mental disturbance; so great indeed is the susceptibility of some persons, that even when applied to the skin in the form of plaster or ointment, belladonna affects them in a marked manner.

Belladonna weakens the muscular power, and renders the gait unsteady and staggering, and a patient may lose control over his movements, and, unable to direct his course, may run against objects he sees, yet desires to avoid.

Most observers state that it produces severe pain in the head, generally situated over the forehead and in the eyes; but sometimes these pains affect the top of the head. Singing in the ears, too, occurs, with more or less giddiness. In persons poisoned by this plant, spasmodic contraction of the sphincter of the bladder has been not unfrequently observed, and a scarlet rash has broken out on the skin—a rash said to be like that of scarlet fever, and to be most marked in the neighbourhood of the joints.*

The first effect of belladonna on the pulse is to increase its quickness, fulness, and force to the extent even of fifty to sixty beats in the minute. Moderate doses at the same time increasing the blood pressure. This condition of the circulation continues till the tongue and mouth become moist and clammy, when the pulse diminishes in frequency, and loses in strength (J. Harley). In fatal cases the pulse grows rapid, intermittent, and weak. Dr. J. Harley considers belladonna a powerful heart tonic, adducing in proof the power of this drug to reduce the frequency and to strengthen the beats of the heart when weakened by disease.

Dr. Nunneley asserts that in the frog, belladonna neither increases the frequency of the heart's beats, nor dilates the pupil. These statements, if correct, show that belladonna

* Mr. J. G. Wilson reports a case where the local application of belladonna produced a general red rash with redness of the throat and dilated pupils.