into the minute structure, functions, and vital properties of plants.

Of the descriptions of the botanist, by means of which we are able to ascertain the true name of a plant, it will suffice to observe that they are of necessity extremely complicated as compared with the descriptions of inorganic bodies; inasmuch as plants consist of many different parts, such as the root, the stem, the leaf, the flower, the seed—each of which parts has to be so described as to be easily recognised; whereas inorganic substances have the same, or nearly the same, composition throughout, each fragment similar to every other.

Of the department of physiological botany, it may be observed, that it presents at least this peculiar difficulty when compared with sciences which deal with inorganic matter, that some experiments which are needful for the clearing up of disputed questions relating to the functions of plants are rendered unsatisfactory by the very circumstance that the subjects of the experiment are constantly undergoing vital changes which are interfered with by the experiments themselves.

The science of botany, in conjunction with the sciences of entomology, chemistry, geology, and meteorology, may be said to have its practical application in the art of gardening, and in that part of the art of farming which has for its object the culture of vegetable substances; and in these arts we see imperfectly set forth the peculiar difficulties which attach to the study and practice of the art of healing. We have to deal with living objects, over the growth of which we can exercise but limited control; while that process of growth is influenced by a vast number of different agencies as difficult to appreciate for purposes of science, as to bring under subjection for purposes of art. Over matter not endowed with life, we can exercise almost unlimited control. We can submit it to the operation of all kinds of force. We can crush it, melt or dissipate it by heat, dissolve or alter it by chemical agents, and transform it by the electric fluid. In short periods of time it undergoes no changes which we do not ourselves bring about. But these living things are in a state of perpetual change. There is a principle at work within them which we do not understand, and can only influence indirectly. From the sowing of the seed in the ground to the production of a plant in its turn bearing seed, external agencies liable to great and constant fluctuations are brought to bear, of which some are quite beyond our control, and others admit of only partial modification at our hands. Plants grown in the same soil, in the same climate, and with the self-same culture, are exposed to a new combination of the elements every year. No single constituent of that proverbially fickle and variable thing, the weather—neither the temperature, nor the fall of rain, nor the force and direction of the wind, nor the pressure of the atmosphere, nor the electric state of the air, presenting the same aggregate results in any two years, or even in any two seasons. Then there are the attacks of insects, and blights, and obscure diseases (such as those which have lately attacked the potatoe and the grape), occurring with strange irregularity; and still further interfering with the natural growth and perfection of the plant, baffling all the calculations of the scientific observer, and disappointing the most reasonable hopes of the gardener and farmer. All these things combine to render experiment difficult, and observation fallacious; and remind us forcibly of those analogous, but still more formidable and perplexing, difficulties which attach to the study of medicine as a science, and to the practice of the art of healing.

From the group of scientific studies which find their practical application in the arts of the gardener and farmer, the transition is easy and natural to the science of states and the art of government—to the abstract studies of the statist and the practical duties of the statesman. Between the work of the agriculturist and the work of the statesman there is an obvious and strict analogy. Each deals with events or results brought about by the operation of a multitude of causes acting with ever varying intensity and to a great extent beyond his control. Take, again, the case of the farmer. The seed he sows is of variable quality; the land he sows it in consists of a variable combination of soils; the mechanical preparation of the soil is more or less complete; no two specimens of the manure which he applies have exactly the same strength; and the crop grows up, arrives at maturity, is cut and harvested, each year under a new combination of atmospheric influences. From the same land, with the same preparation, the same quantity of the same manure, and, as nearly as he can judge, the same seed, he one year obtains an abundant, another year a scanty, crop.

So also with the scientific statesman. Relying upon the

best information which he can procure, and basing himself upon the most accurate returns he can obtain, he makes some great financial change. But he is disappointed in the results, because he falls upon evil times—upon one of those cycles of years in which nothing prospers—or, he obtains an unwonted and unmerited success, because he happens to operate in a fortunate cycle of years. The unlucky statesman may encounter a bad harvest, or a series of bad harvests, a glut of foreign markets, a monetary crisis, an epidemic, rumours of wars, and popular outbreaks; and these things make themselves felt in the national balance-sheet, and insure the failure of all his calculations. His successor, on the contrary, when he attains to office may find everything taking a favourable turn. Abundant harvests at home and abroad, an active and remunerative commerce, an easy state of the money market, a sound condition of the public health, the best possible relations with foreign states, contentment among the people—all this, aided, perhaps, by the discovery of some new and unexpected source of wealth at home or abroad; and these things working together make all his plans to prosper, and all his reforms to seem the inspirations of genius. Like the physician, therefore, who gains credit where he does not deserve it, and loses it where he is not to blame, the statesman is often successful or unsuccessful through the concurrence of causes over which he can exercise no control.

In the sciences and arts which have to do with beings of a lower organisation endowed with life, such as the entire vegetable kingdom, and with the complex interests of human societies: in the science and art of agriculture and in the science and art of government, we see reflected, as in a mirror, but faintly and dimly, the difficulties and perplexities which surround the science of medicine and the art of healing. This important subject must be reserved for separate consideration.

[To be continued.]

Clinical Lecture ON OPIUM: ITS USE AND ABUSE.

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[Concluded from page 315.]

THE cases I have now brought before you, amply illustrate the wonderful efficacy of the narcotic power of opium. Opium soothes the nervous system, and renders it comparatively insensible to the operation of disturbing agencies, whilst by inducing tranquil sleep, it procures for the central organs that season of rest and repair, for which nature has provided in the state of health, by the periodical recurrence of night after the day, and without which those organs must undergo progressive wasting and degeneration. By restoring health to the nervous system, opium also indirectly invigorates the nutrition of the entire body; it restores energy to the functions of digestion and assimilation, renovates the muscles, and in so doing, strengthens the organs of circulation and respiration. It thus produces the effect of a tonic and a stimulant, and I have always thought that opium was indebted to this, its indirect action, for much of its stimulant property. It removes the depressing irritability and restlessness of exhaustion, whether induced by hæmorrhage, or by physical injury, and robs depressing influences, such as severe pain or intense cold, of half their power, by rendering the nervous system insensible to their operation.

I must now reverse the picture, and speak of the failure of opium. Like many other medicines, opium acts only in certain conditions of the system favourable to its operation, but such conditions appear to be of a very special nature. I put out of the question those constitutions which are entirely intolerant of its influence, though this circumstance constitutes a great obstacle to its general employment. But beyond such cases, there are many individuals in whom the medicine entirely fails either to soothe or to cause sleep. The stomach and digestive organs must be free from any great disorder, for opium to act favourably; this is a very important rule, and applies to opium as forcibly as to tonics; but there may be, and often is, something in the constitution of the nervous system itself, either natural or induced, which occasions resistance to the beneficial operation of the

medicine; just as excessive excitability is natural to some nervous systems, so an indisposition to yield to soothing influences is also natural to them. A state of considerable mental perturbation will often refuse to be calmed by opium, and even the same condition in a very minor degree; thus you may often observe, that patients, when first entering the hospital, will become sleepless for a time, in consequence of the new relations in which they are placed, and you will find that an evening opiate is often ineffectual in remedying the evil. I have even noticed a remarkable change take place in the nervous system, in its behaviour towards opium; a patient of mine, often the subject of wakefulness and of neuralgia, who uniformly derived the greatest comfort from an occasional dose of opium, now entirely fails in obtaining any relief from the medicine, even in increased doses; the pain is not abated, and the wakefulness is even increased; and a young gentleman, subject to fits of violent muscular excitement, who formerly relied upon opium, is now intoxicated by its influence, although the dose has been increased.

It is a well known fact, that in certain diseases, characterised by high excitement, opium is altogether inoperative; in tetanus, one thousand five hundred grains of solid opium have been taken in seventeen days. Dr. Chalmers (*Medical Observations and Inquiries*, i, 103), has given two hundred drops of tincture of opium at a dose; some patients, he adds, will take more than an ounce and a-half of laudanum in twenty-four hours, without experiencing its narcotic influence. Mr. Curling (*On Tetanus*, p. 56) mentions a case of tetanus, in which a drachm of laudanum was given every half-hour through the night, and sleep was not induced. During the passage of gall-stones, more than eight hundred drops of laudanum have been administered in less than twelve hours; and I need not refer more specifically to the effect of hæmorrhage in inducing tolerance of opium to a surprising degree.

Bearing these facts in mind, you will not be surprised at finding that opium often fails to induce sleep, in the class of cases with which we have been occupied; when the nervous system has been subjected, for a lengthened period, to the operation of sustained excitement, and when, moreover, the central organs have been lowered in their nutrition, and rendered thereby additionally prone to fall into an irritable condition, the calming properties of opium lose their effect. In a patient now in the hospital, who habitually disturbs those around him, by screaming at night, two grains of opium, given for a succession of nights, have not succeeded in gaining for him repose; an out patient, who has long been the victim of intemperate habits, has been taking two grains of opium nightly, for a considerable length of time, with very little benefit; and we have at present several other patients who have proved equally rebellious to the power of their medicine.

It happens, sometimes, that this state of unconquerable excitement and irritability attends the last days of certain individuals who have fallen into a state of great debility. I am now attending a lady, who is approaching her end, with symptoms of considerable depression of the power of the heart, in whom a state of excitement is very partially subdued by narcotics; and in one of the most painful deaths from degeneration of the heart, which I have witnessed, excitement amounting to mania, prolonged through twelve days, with nearly constant wakefulness, constituted a most distressing complication of the case. (*Provincial Medical and Surgical Journal*, 1852, p. 618).

Under circumstances such as those I have now mentioned, the question naturally presents itself, are we justified in meeting unusual resistance to the operation of our remedy, by a corresponding increase in its dose?

In attempting a reply to this inquiry, I have to present opium to you, from a different point of view, in relation to the injurious effects which it is capable of producing. The tendency of opium to constipate the bowels, to dull the desire for food, and to diminish the secretions, often creates inconvenience, though not sufficient to present any grave objection to its use. But there is another effect of opium of a far more serious nature; it undoubtedly exerts a directly and often very powerfully depressing influence upon the heart, particularly in cases where that organ has been already enfeebled by nervous depression, or by disease of its muscular fibres. The large doses of opium which patients will endure, when suffering from the collapse of hæmorrhage, or of severe injury, afford no proof that in conditions of far less exhaustion of the heart's power, induced by other causes, opium may be administered with equal impunity. I have seen a girl, poisoned by opium, perfectly pallid, and in such a state of collapse, that it required the support of two assistants to enable her to continue the perambulations necessary for her recovery; and the small quick irregular pulse of the first stage, the cold and pallid skin, the pale and ghastly expression of countenance of the second stage, enumerated by Dr. Taylor as among the symptoms produced by the poisonous action of opium, clearly evince the depression under which the circulation is labouring.

You will frequently find that patients who take opium to procure sleep, complain of nausea, even of vomiting, giddiness and faintness, when they rise on the following morning; occasionally, our hospital patients have suffered so acutely from these symptoms, that some persuasion has been needful to induce them to continue their medicine. I remember experiencing a striking proof of this sedative action of opium in my own person: having taken ten grains of Dover's powder, when suffering from an inflamed tonsil, I first experienced excessive nausea and sinking at the epigastrium; as these sensations increased, the pain and difficulty of swallowing were so entirely removed, that I firmly believed that an abscess in the tonsil had burst; the effect was precisely the same with that which had followed the previous application of leeches; unfortunately, it was even more transient.

M. Trousseau (*Medical Times and Gazette*, February 1859) has especially remarked upon this sedative action of opium upon the heart. He mentions two cases of heart-disease in which sudden death followed a single moderate dose of opium; and my friend, Dr. Johnson, has noticed the same circumstance.

The caution which is requisite, in the use of large doses of opium, in consequence of its possessing this tendency, has been observed by other pathologists in relation to the treatment of certain diseases. Thus Dr. Morehead (*Diseases of India*, ii, 638) objects to strong doses of narcotics in tetanus, because, associated with narcotics, there is always a failing action of the heart, and therefore, under the influence of narcotics, given in large quantities, the tendency to death by syncope, always distinct and important in tetanus, becomes seriously increased. In a case which occurred in Ireland, two years ago, and excited considerable attention at the time, death was distinctly referred, by a physician and surgeon of great eminence, to the debilitating effects, upon a heart already in a state of fatty degeneration, induced by large doses of opium, combined with full bleeding, for the relief of the pain of gall-stones (*Times*, November 10, 1857); and the opinion given gained greater importance from the uncertainty which the witnesses admitted to attend the early stages of cardiac degeneration.

The considerations I have now advanced must suggest caution in increasing the dose of opium, at least under the circumstances which I have mentioned; they suggest, also, the necessity of combining stimulants with the narcotic, and of enforcing the taking of food. You will often find that the mind, being preoccupied by painful thoughts, the stomach has felt little or no inclination for food, and that the feebleness natural to the disease has been increased by abstinence. It may, I think, be accepted as a rule, that wherever opium is required, stimulants will always be admissible, and will frequently be necessary; and with stimulants we must combine very careful attention to diet, administering food of a simple but nutritious character.

There is one disease which combines, in a very especial manner, the application of all that I have said respecting the advantage, the disadvantage, and the failure of opium; I mean delirium tremens. Among the symptoms of this disease, one of the most prominent, and certainly the most important, is obstinate wakefulness, which generally precedes the attack for some days, and continues through its duration. Wakefulness is at once a measure of the excitement, and a source of great danger. "If the patients pass many nights without sleep," says Dr. Watson, "they will die." Consequently, to procure sleep for the patient, and thereby to allay the excitement of the nervous system, and to recruit the energies of its central organs, becomes a leading principle in the treatment of the malady.

Now, delirium tremens very often affords most striking illustration of that obstinate resistance to the narcotic power of opium which I have already noticed; and if we are determined to procure sleep, we must not unfrequently be prepared to employ very large doses, and to repeat them frequently. Thus Dr. Morehead (*op. cit.*, vol. ii, 558) mentions one case of the disease in which two grains of opium were given in the evening; on the next evening a grain and a half of morphine; on the following day fifteen minims of laudanum every second hour, and in the evening two grains of opium every second

hour, for three hours; next morning three drachms of laudanum, and in two hours afterwards, two drachms more, were administered.

In another case, by the same author, a drachm and a half of laudanum was given in the evening; the following day half a drachm of solution of morphia every second hour, and in the evening, a grain of morphia. On the following day, two drachms and a half of laudanum; in two hours a drachm; and three drachms again in the evening, followed, in two hours further, by a drachm and a half. In neither case was any sleep, sounder than a doze, the result.

I treated two cases of the disease myself, on the same principle, some years ago, when in charge of a public institution, as resident officer; in both cases I repeated drachm doses of laudanum, every two or three hours, without success. In all these cases, due attention was paid to supporting the strength, by stimulants and by nourishment, but in all the patients died. In one of my own cases, the change from a state of high excitement to one of entire insensibility, with utter collapse, was fearfully rapid, and my notes of both the cases indicate evident signs of a tendency to prostration in the patients, by a feeble and rapid pulse, sobbing, respiration, tremulous limbs, and a surface bathed in perspiration. In a milder case, which occurred in the hospital the other day, you witnessed a similar failure of the opiate treatment. Now, in the history of delirium tremens, there is a circumstance of great moment in relation to the present subject—the great liability in the patient to degeneration of the heart, which, of itself, will sometimes bring the case to a suddenly fatal termination. To this I must add, that the secreting instruments of the kidney are rarely in a healthy condition. Various forms of advanced degeneration of the kidney are common results of intemperance; and, even when the disease has not attained this serious character, the epithelial cells will be found unhealthy, loaded with fatty and granular matter; as a consequence, the blood will probably be impure, and it is a well known fact, that impure conditions of the blood render the nervous centres more than usually exposed to the injurious operation of narcotic poisons. The extent of such changes will bear relation to the nature of the patient's habits, and to the length of time he has indulged in intemperance. Thus, in a first attack of delirium tremens, and in a tolerably healthy subject, but little anxiety need be felt for the result; the fit will probably subside of itself; whilst, on the other hand, when many previous attacks have occurred, the chances of recovery are much lessened.

Dr. Watson observes, that patients, in delirium tremens, "are apt to die much in the same way as patients who are poisoned by opium" (*Lectures*, 4th edit., i, 414). Now, when we recollect that what is commonly distinguished as apoplectic coma is sometimes induced by lowered nutrition of the brain, or by deficient supply of blood to that organ, it seems highly probable that such deaths are the consequence of failing power in the heart, more especially as we often find, after death, much increase in the subarachnoid fluid, together with pallid, shrunken, and widely-separated convolutions, evident signs of a wasted state of the cerebral tissue, a state most liable to suffer from any further depression in its nutritive conditions.

To apply these remarks to the case in question, I believe that it is better to introduce the element of time into our treatment of delirium tremens, and to endeavour to obtain the aid of opium, by administering it in moderate doses, but at regular intervals, whilst we combine with this plan of treatment all the aids we can obtain from quiet, darkening the room, cooling applications to the scalp, and the judicious employment of food and stimulants.

And I may add, that I think the regular administration of small doses of opium, at short intervals, will generally be more likely to be effectual, in obstinate cases of nervous disease, than single and powerful doses. We thus obtain the sustained operation of the remedy, which may succeed at last in overcoming the resistance opposed to it.

One word, before I conclude, on the employment of opium in fever. This is too wide a subject for me to do more than to make one remark in connection with it. We may sometimes notice, in the course of a single case of fever, or by comparing two cases with each other, two periods in the disease which present a very different, even an opposite relation to opium. In the early, and especially in the middle stage, we occasionally encounter a state of very wild delirium, approaching somewhat to mania; this happens chiefly in highly irritable, excitable subjects, and we noticed it in a girl, who died of fever some time ago, who had been exposed to a severe mental shock shortly before her illness; now, in this condition, we may meet

with considerable resistance to the calming influence of opium. On the other hand, in the later stage, when the temporary support afforded by the febrile reaction has subsided, or when the patient has been much prostrated by the operation of the poison, and the muscular fibres of the heart are softened, the greatest caution is needed in giving opium, on account of the powerful effects it induces. I have seen a patient, under these circumstances, thrown into a deep sleep, lasting for many hours, by six minims of Battley's solution.

On some future occasion, I may speak to you of the different medicines which are employed as substitutes for opium.

Original Communications.

ON INTRAVASATION, EMBOLIA, AND CYTOSTASIS, AS CAUSES OF CEREBRAL AND OTHER PARALYSIS.

By J. L. W. THUDICHUM, M.D.

[Read before the Medical Society of London, April 23rd, 1860.]

THE morbid conditions of the blood-vessels which, under the name of phlebitis and arteritis, had for many years been catalogued with typical inflammations, have during the last decennium received unexpected elucidation and a convenient nomenclature through the thoughtful labours of Virchow. It had no doubt many years ago been recognised by Cruveilhier that the coagulated masses found in veins, when in a state of so-called phlebitis, were not fibrine exuded from the wall of the vessel supposed to be inflamed, but coagula of blood simply, having no connexion with the contiguous membrane. The puriform substance, which is frequently found in the centre of these coagula, Cruveilhier continued to interpret as true pus, and admitted a migration of this pus from the membrane, on which it was supposed to have been bred, into the interior of the coagulum, by means of an unintelligible force termed by him "capillarity". The somewhat startling experience, that inflammation of the vein or phlebitis should always begin with a coagulation of blood in its lumen, caused the French pathologist to assume that all inflammations originally began with a coagulation of the blood contained in certain small veins, the existence of which was supposed, without further inquiry. Cruveilhier failed to work out the necessary deductions from his observations. Misunderstood and misinterpreted by many, his doctrines never obtained even general notoriety. For both the notice of Cruveilhier's somewhat mystical assumptions, and the true interpretation of his classical observations, the larger circle of medical readers is indebted to Virchow, who dissolved the doctrine of phlebitis, and substituted for it the expression of the simple fact, by arranging under the denomination of "thrombosis" those pathological conditions which consist in the closure of a vein by blood-coagula formed in the identical locality in which they are met with. The next step in this reform consisted in assigning its proper nature to the process by which a matter resembling pus was formed in the centre of these coagula. The differences from pus were in many cases so striking, inasmuch as the matter was often found destitute of the cellular elements characterising pus, and presented the granules simply of decomposing fibrine or decomposing blood-corpuscles, that even those cases where cells not distinguishable from pus-cells were found could be interpreted by those in which they were absent; in this sense, namely, that they were cases in which a thrombus consisting of coloured and colourless blood-corpuscles and fibrine had undergone the simple chemical process of softening; and that the fluid product was not pus, but *detritus*, the cellular elements of which were white blood-cells, which, by their greater durability, had outlived the destruction of the red corpuscles and of the fibrine.

The entrance of this *detritus* into the current of the venous blood had more frequently been assumed than observed. So long as it was confounded with pus, it was one of the principal factors in the theory of pyæmia, which, while almost entirely overlooking the possible mechanical effects of the entrance of this matter into the blood, attributed its main pathological importance to the poisonous nature of the liquid, which, by