

I was the first (in 1868) to propose the use of phosphorus in locomotor ataxia.

Delpech had several years before (in 1863) applied phosphorus to the treatment of certain paralyzes from chronic poisoning, and in particular to that produced by sulphide of carbon. I have continued this phosphorus medication, and, although I have never obtained a cure by this remedy, I have in many instances noted amelioration, characterized by a sensation of increase of force, and diminution of incoördination. But the same reservations which I made *à propos* of nitrate of silver, ought to be made here, and one may well ask if in many cases the amelioration obtained is not rather the consequence of the natural march of the disease than of the action of the medicine. My pupil, Dr. Eugene Lemaire, has published in his remarkable thesis on the employment of phosphorus the greater part of those observations.¹

This phosphorus medication needs to be closely watched, and I am going to enter into certain details which appear to me to be necessary. When I commenced my experimentation with phosphorus, I immediately stumbled against a difficulty, the unreliability and the danger of the preparations in use; and I proposed to substitute for the phosphorated oil of the codex,² solutions of phosphorus in chloroform, of definite strength, and I also had capsules made containing one milligramme ($\frac{1}{80}$ grain) of phosphorus. But attention was awakened on this point, and thereupon successively appeared the monographs of Mehu and Vigier.

Mehu showed that while the *oleum phosphoratum* of the codex, as ordinarily prepared, is of uncertain strength, a sufficiently good solution might be had by heating the oil very hot, and henceforth unalterable capsules of phosphorated oil might be obtained, each containing one milligramme of phosphorus. Vigier, by his studies on the metallic phosphides, showed the advantage which might be derived from these preparations, and he introduced phosphide of zinc into therapeutics.³ These capsules of phosphorated oil, and Vigier's pills of phosphide of zinc, are to-day the preparations of phosphorus most in use.

When you prescribe phosphide of zinc, do not forget that four milligrammes represent one milligramme of phosphorus. Whether you make use of granules of phosphide of zinc containing four milligrammes, or capsules of phosphorated oil containing one milligramme, you ought to observe the following rules: Commence with one pill, or one capsule, and increase gradually till ten are taken in the twenty-four hours; continue this dose three or four days,

¹ Dujardin-Beaumetz, sur l'Emploi du phosphore en médecine et en particulier dans l'ataxie locomotrice progressive. *Bull. Gén. de Thér.*, 1868, t. lxxiv. pp. 16, 157, 203, 302.

N. Gueneau de Mussy, On the Treatment of Mercurial Trembling by Phosphorus. *Gaz. des Hôp.*, 1868, Nos. 48 and 50.

Lemaire (Eug.), On the Therapeutic Employment of Phosphorus in Certain Affections of the Nervous System. *Thèse de Paris*, 1875, No. 143.

² The phosphorated oil of the codex contains two grammes (3 ss) of phosphorus to one hundred grammes (3 iij, 3 ijss) of oil of sweet almonds, and is an uncertain preparation.

³ Vigier, On the Therapeutic Employment of Zinc Phosphide (*Bull. Gén. de Thér.*, t. lxxiv. p. 268).

then suspend the medicine for five days, to renew the treatment by commencing with one capsule. These interruptions in the phosphorus medication are necessary in order to avoid accumulation of action, and to permit the medicine to be eliminated. In following these rules the phosphorus treatment can be continued with safety for months or for years. I add that in order to render the medicament more tolerable to the stomach, you would do well to order the phosphorus to be taken at meal time, you will then avoid in great part the eructations of *lucifer-match* taste which follow the administration of this remedy. There is another caution to be observed in prescribing phosphorus in tabes. It will not do to give it when there are any symptoms indicating any considerable degree of congestion or irritability of the nervous system, nor in the case of gastro-intestinal troubles; moreover, to get any good from the phosphorus treatment it must be continued a long time.

On what is this action of phosphorus in locomotor ataxia based? Here, as in the case of nitrate of silver, we are obliged to make hypotheses. My own theory is the following: Ranvier, in his experiment with phosphorus, has shown that when this metalloid is inserted under the skin of animals, you do not provoke inflammatory disorders, but you determine arrest of the formative and nutritive operations of the histological elements. It is possible that in the spinal cord phosphorus thus opposes the proliferation of the neuroglia; but, I repeat, this is only a hypothesis, and I give it for what it is worth.

Now that we have taken a general survey of the different modes of treating medullary affections, let us study the indications of treatment in the different forms of myelitis. I cannot here speak of all the varieties of spinal inflammation—their number is considerable. You will find in the work of Grasset a table (see next page) which gives a good summary of all the kinds, and which will enable you to judge of their number. I shall only call your attention to those cases which you will oftenest be called to treat, the congestions of the spinal cord, the meningo-myelites, the myelites by compression, sclerosis of the posterior columns, disseminated sclerosis, and, in fine, that form known as atrophic paralysis of infancy, or sclerosis of the anterior cornua.

The congestions of the spinal cord are frequent, and their causes are multiple;¹ they do not generally entail anything more than a relative incapacity

¹ The causes of congestion of the spinal cord are numerous; the most frequent are:

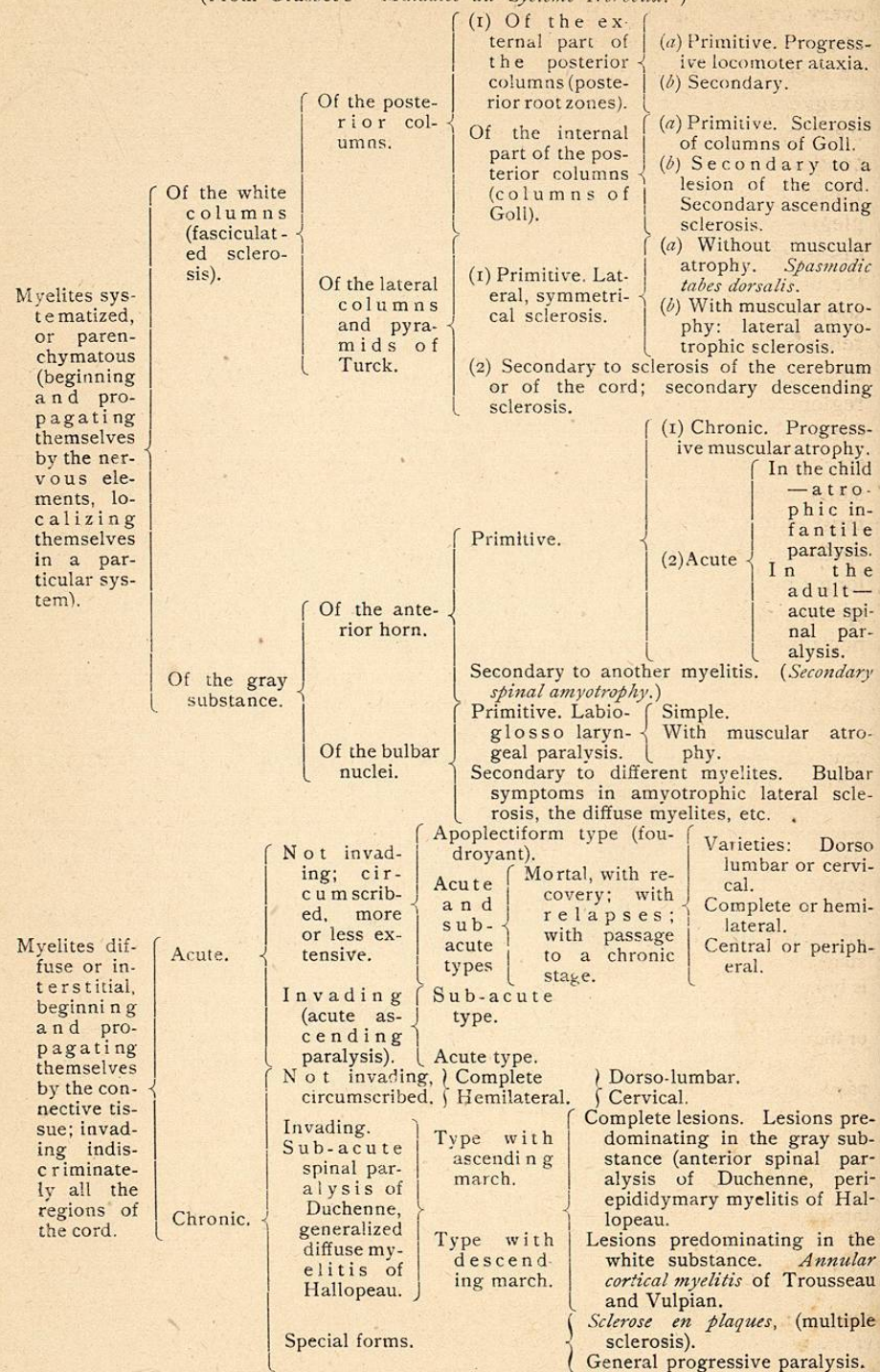
Exposure to a very cold temperature, the incipient stage of fevers, especially paludal fevers, small-pox, and typhoid fever. Next in order of frequency come alcoholic excesses, venereal excesses and a too prolonged standing posture, extraordinary muscular fatigue, violent exertion, sometimes convulsive attacks; even the suppression of an habitual flux, menstrual or hæmorrhoidal, etc.

Traumatism, blows, or falls injuring the vertebral column, may produce spinal congestion; also sudden changes in the exterior atmospheric pressure on the body. Rabington, Cuthbert and Clark have published instances of congestion so produced in laborers who, working in diving-bells, had been in the habit of abruptly entering or leaving these compartments of compressed air.

Passive congestion has for its cause venous obstruction, as is observed in cirrhosis of the liver, pregnancy, abdominal tumors, and diseases of the heart or lungs.

The symptoms of spinal congestion consist especially in lumbar or dorsal pains, rarely

CLASSIFICATION OF THE MYELITIS.

(From Grasset's "*Maladies du Système Nerveux*.")

or paresis of the lower extremities, a paralysis in its nature curable. As in every hyperæmia, the first indication is to suppress the cause of which it is a manifestation; and whether the medullary hyperæmia depends on rheumatism, on uterine or hæmorrhoidal congestion, on too prolonged dorsal decubitus, on exaggerated fatigue, or on sexual excesses, your therapeutics should be varied to meet the causal indications. Rheumatism is one of the most frequent causes of congestion of the spinal cord, and, for my part, I remember to have observed, with Lasègue, during my earlier student days, a very curious case of sudden paraplegia in a kitchen maid; it was a result of acute articular rheumatism, and disappeared when the joints became affected. In these cases you understand the utility of dry or wet cups along the spine, of steam baths, and salicylate of sodium. At other times you will have to deal with simple paralysis *a frigore*, reflex paralysis from the impression of cold on the cutaneous surface. Here the treatment is different; besides the ordinary revulsives, such as blisters to the spinal region, you may employ sudorifics, and particularly pilocarpine, which, by the cutaneous congestion which they produce, have a favorable effect on the paralysis. Prolonged fatigue, by reason of the physiological congestion which it occasions in the spinal cord, is a factor in the etiology of this affection; here you must enjoin absolute rest, as well as revulsion. This word *rest* leads me to speak of the effect of dorsal position in the affections of the cord. Lying a long time on the back induces, as you well know, passive congestion of the spinal medulla, and it is probably to this congestion that we are to attribute the nocturnal erections which take place during sleep. You understand, then, that this fact has a certain influence in affections of the cord, and you will see patients predisposed to spinal congestion who, by reason of the dorsal decubi-

acute, accompanied by a sensation of numbness and formication in the legs. The patients complain also at times of an intense feeling of heat in the back.

When the inflammation is seated in the dorso-lumbar region, the inferior members present troubles of sensibility and motility; there are sensations of pricking, crawling, or tingling, in the limbs, numbness in the toes; the skin also presents anæsthetic points existing concurrently with hyperæsthesia.

Motility is more or less affected. There is always paraplegia, generally, however, incomplete; the patient walks with difficulty, dragging his legs along; at a more advanced stage he can no longer walk, he keeps his bed, but even then he can move his legs when he is lying down or sitting up.

The muscles of the bladder and rectum are often paralyzed; there is retention of urine or incontinence, and sometimes retention of fecal matters.

In active congestion of the cord, the invasion is sudden and the course is rapid; the pains are more severe, and the paraplegia complete.

In passive congestion the symptoms develop more slowly, appear more tardily, and the pains sometimes precede by several days the appearance of the paraplegia which remains incomplete.

In the active form the reflex movements are often exaggerated; they preserve their integrity in the passive form.

The duration of the disease is variable. Passive congestion lasts as long as the causes which originate it.

Congestion caused by traumatism, by an eruptive or paludal fever, disappears in the course of a few days. When the inflammatory state persists with fever for several days there is reason to fear the development of a more serious affection.

tus of the night can scarcely support themselves on their feet in the morning. This paresis disappears after standing a short time, with disappearance of the congestion which caused it.

This fact has a certain importance, and Brown-Séguard has derived from it therapeutic hints. In anæmia of the spinal cord, he directs the patient to lie on his back, while in spinal hyperæmia he is to lie prone on his abdomen.

Thus far I have said nothing of bloodletting, which has been much employed in affections of the spine. Very much vaunted formerly by Ollivier, who advised in these cases, besides general bleeding, leeches to be applied in great number to the dorsal region, and wet cups, this antiphlogistic treatment is to-day well-nigh abandoned.¹ At the same time wet and dry cupping may render considerable service in active congestions of the spinal cord, and it is a therapeutic measure not to be neglected.

Meningo-myelitis, whatever may be the cause, is one of the medullary affections the most frequently observed. It is characterized by two marked symptoms; first, by pains, often severe, coming in paroxysms, and bearing considerable resemblance to the *douleurs fulgurantes* of ataxia and to sciatic neuralgia; secondly, by impotence, more or less complete, of the inferior extremities, with conservation of sensibility, the external portions of the medullary columns being alone affected. Here energetic revulsion is indicated, preferably by cauterizations along the spine.² You must also assuage the pain, for this is one of the symptoms of which the patient most complains. All the various remedial measures which I spoke of under the head of the neuralgias will have

¹ It is especially in the case of spinal meningitis and concussions of the spinal cord that Ollivier has recommended copious blood lettings; these, to be general or local. He advises that when general blood letting is preferred this should be done thoroughly, and he insists on its repetition where the patient is young and vigorous; where local bleeding is chosen he advises the application of wet cups the whole length of the spinal column, and each side of the spinous processes.

With regard to cupping, Gosse of Geneva proposes that deep incisions should be made in the muscles along the vertebral grooves in order to open the veins which communicate directly with the spinal canal.

Ollivier condemns this practice. (a)

² Debove has recently proposed in these obstinate cases a mode of treatment, especially applicable to sciatica, which consists in spraying the seat of pain with chloride of methyl. In sciatica the gas is projected over the tract of the nerve from a siphon bottle, furnished with suitable stop-cock and beak. Intense refrigeration is produced, followed by smarting and even vesication; the latter may be very troublesome if the spraying be too prolonged. Rightly managed, this mode of treatment is said to be of singular efficacy, and superior to any other. Debove claims astonishing cures where everything had failed. Desnos, Rendu, Lallier, Legroux, Sevestre, Robin, Letulle and Dujardin-Beaumetz have all tried this process with varying success. It seems to do good rather by revulsion than by refrigeration; the innervation of multitudes of sensory nerve terminations is modified by the methyl-chloride spray, and some marked sedation in the central nuclei of these nerves in the cord seems to follow; at least it is substantially in this way that Debove accounts for the success of this new treatment.—TRANS.

(a) Ollivier *Traité des maladies de la moelle épinière*, Paris, 1837, t. 11, p. 299.
Gosse, *Des maladies rhumatoïdes*, Geneva, 1826, p. 231.

their place. Double sciaticas ought always to make you suspect meningo-myelitis. But the most effectual means for allaying the pain is the subcutaneous injection of morphia, and, in fact, this alone will in many cases bring relief. You must also watch the functions of the bladder and intestines, which are often profoundly disturbed in these cases of paraplegia due to spinal disease.

As for the condition of the bowels, we have either obstinate constipation or fecal incontinence. The constipation will yield to drastic purgatives; these medicaments not only restore regular stools, but they act as revulsives and may thus modify the circulation in the cord and its membranes. In certain cases the most violent purgatives cannot overcome the constipation; this is because the rectum is paralyzed and allows itself to be distended beyond measure by fecal accumulations. Here you will have to break up the fecal mass with the finger, or scoop it out with a spoon in order to clear the rectum.

As for fecal incontinence, the most scrupulous pains must be taken for cleanliness; nothing is more important in myelitis, for trophic troubles are of common occurrence, and often, in spite of all your care, extensive bed-sores will form over the sacrum, and even around the anus, as a consequence of dorsal recumbency. In these cases the fracture-bed will render great service; it enables you readily to dress the bed-sore, and to vary the position of the patient.

The disorders which meningo-myelitis inflicts on the urinary organs are still more serious. At first the patient often experiences some tenesmus due to spasm of the bladder, tenesmus which soon gives place to retention or to incontinence. For the retention, you will be obliged to use the catheter, notwithstanding the liability to cystitis with purulent urine which it occasions. For the latter evil, and to prevent putrid absorption, it will be necessary to wash out the bladder with solutions of carbolic, boracic acids, resorcine, etc., at the same time giving internally benzoic acid, oil of sandalwood, turpentine, copaiba, boldo or buchu, which are antagonists of fermentation.

If retention of urine has inconveniences, incontinence has quite as grave; the incessant flow of urine irritates the genitals, soils the bedclothes and the clothing, and augments causes already existing of local gangrene and erysipelatous inflammation of the skin. In the case of male patients, urinals have been perfected by the use of which they can escape these accidents, but it is not so with the paraplegic female, who must suffer all the ill consequences of the incontinence.

When the inflammatory symptoms have subsided, then much can be done to restore the power of movement to the lower extremities. Here hydrotherapy, massage, frictions, electricity, may render real service; but these measures should never be employed in the acute stage of the affection, for they would cause aggravation of the disease.

Myelitis by compression demands the same local treatment as meningo-myelitis; it demands also a special treatment directed to the removal of the cause. If the latter be cancer of the cord or its membranes, we can do nothing but alleviate pain by hypodermic injections of morphia. If it be Pott's disease,

we can by an appropriate plaster jacket, as Sayre, of New York, recommends, do much toward straightening out the vertebral column, and removing the deformity which is the cause of the compression. If the cause be syphilis, nothing can be more serviceable than the injections of peptonate or albuminate of mercury, which not seldom cause the myelitis and paraplegia rapidly to disappear.

I come now to the treatment of the medullary sclerosis, and especially of the typical form oftenest met with in practice, progressive locomotor ataxia.¹ This word *progressive*, by which Duchenne characterized the pathological entity

¹Locomotor ataxia, described under the names of tabes dorsalis, spinal paralysis, atrophy or gray degeneration of the posterior columns of the cord, was scarcely known in France, before the researches of Duchenne de Boulogne, and our knowledge of the pathological anatomy of the disease, dates especially from the memoir of Burdon and Luys.

It is a chronic disease with slow and progressive march; seeming at times to be arrested in its progress it presents periods, more or less long, of quiescence; it takes four, five, six years and even more for its evolution. It is primitive or secondary; it commences ordinarily between the ages of twenty and thirty years and seems to be more common in men than in women. It is often hereditary, the family history revealing ataxia or other diseases of the nervous system.

Articular rheumatism, venereal excesses, nervous affections, traumatism of the cord, may cause the development of the disease.

The influence of syphilis, denied formerly, seems to-day indisputable, and according to Prof. Vulpian, out of twenty patients afflicted with locomotor ataxia, at least fifteen of them were old syphilitic cases.

The evolution of the disease presents three periods: a first, or painful period; a second, or period of ataxia; a third, a period of paralysis.

The first, or period of lightning pains and ocular troubles, may manifest itself suddenly, but this is somewhat rare. In this event there are violent paroxysms of pain in the limbs, the head and the trunk; these attacks subside to return again at variable intervals.

Often the invasion has not this suddenness and the pains do not present so much violence; the patient complains of transient, rapid pains. These pains, often quite severe, shoot downward through the lower limbs like lightning shocks (*douleurs fulgurantes* of Romberg). At other times they resemble bites, pricks, pinchings; they may be accompanied by sudden starts. Of variable intensity, they are ordinarily transient, but may also be persistent and localize themselves in different points. When situated in the trunk the pains are constrictive (*douleurs en ceinture*) and their violence sometimes impedes respiration. In the face they affect the fulgurant type and the persistent or continuous type; the patient complains of constant pains, with exacerbation, and exaggerated sensibility of the skin about the orbits, at the root of the nose, or around the infra-orbital foramen; sometimes even the patient says that it seems as if his eyes were being plucked out. On the part of the organs of vision you note troubles consisting of paralysis or paresis of the third or fourth pairs of cranial nerves, fall of the upper eyelid, strabismus (often alternate strabismus) amblyopia, or diplopia more or less marked. These disturbances may, however, be but temporary. Besides these symptoms, the first phase of the disease presents also troubles of the general sensibility, functional derangements of the genito-urinary apparatus, partial paralyses, rarely hemiplegia.

The troubles of the general sensibility consist in anæsthesia, analgesia, hyperæsthesia and divers paræsthesias.

When the skin of the sole of the foot is affected with anæsthesia, the patient loses the sensation of resistance and of hardness in the ground on which he treads; he seems to himself to walk on down or on soft and yielding earth.

On the part of the genito-urinary apparatus, you may note retention or incontinence of

which he described, indicates the little control which therapeutics has over this morbid condition, and in so designating it, Duchenne pronounces a sentence of incurability. Since then, therapeutics has not lifted this sentence, and it is best to bear in mind that this affection is almost always above the resources of our art. Nevertheless, ataxic patients have been cured, and are now being cured; but these are exceptional cases, and despite periods of calm and respite which may last months and even years, the ataxic individual sees his disease progress slowly or by bounds.

These cases of cure concern more especially syphilitic patients. Without adopting altogether the opinion of Fournier, who will have it that all ataxic patients are syphilitic, it is nevertheless well to remember, that in a great number of cases syphilis is the cause of tabes, and when the affection is taken at the commencement, an appropriate anti-syphilitic treatment may cure it. But it will not do to take for granted that it is always so; and in a great many in-

urine (the latter generally nocturnal) satyriasis, then later, anaphorodisia and sometimes spermatorrhœa.

The painful crises may affect the viscera and determine gastralgic paroxysms with vomiting, vesicular and urethral pains, or lumbar pain simulating renal colic. Féréol has remarked laryngo-bronchial troubles with spasm of the glottis and convulsive cough and hyperæsthesia of the laryngeal mucous membrane.

As for the second phase of the disease, it is characterized by the appearance of ataxic movements. The incoördination of movements is developed progressively, slowly, little by little, sometimes even insidiously.

The ataxia begins in the lower limbs; the patient remarks first of all that he is very easily fatigued, that he cannot take long walks; then he observes that he is becoming clumsy in his legs, he stumbles and falls easily; it is difficult for him to start off when he attempts to walk, then after several hesitating steps he walks to better advantage. Later the incoördination makes progress, the patient cannot direct at will the force, the direction and the extent of his movements, he cannot take a step without looking at his feet; the leg is lifted up and then thrust forward with force and stamped on the ground heel first; he can no longer walk without a cane or some other support; in the night time the incoördination is still more marked, and walking and even standing becomes almost impossible.

If a patient is lying down he performs quite easily the movements demanded, but sometimes he performs them too violently and overdoes it.

The muscular force is intact, as one can convince himself by means of the dynamometer; coördination alone is wanting.

Like phenomena may be observed in the upper limbs, and little by little manual exercise becomes impossible.

Sensibility also presents disorders; diminution, abolition or perversion of the sensations of touch and of pain. Moreover, a notable retardation in the perception of an impression is observed. A patient, when pricked, does not feel the pain till four or five seconds later; there are mistakes of place, the ataxic with his eyes shut cannot indicate the point pricked. At the same time impressions produced by the contact of a cold body are more rapidly perceived, and the mistakes of place are less obvious.

The sensibility of the muscles (the muscular sense), of the bones, of the joints, is equally affected, the patients lose the notion of position; that is to say, with their eyes shut, they cannot indicate the position of their feet in the bed.

There are often observed at the end of the first period or beginning of the second, arthropathies, well described by Charcot, which occupy preferably the large joints, knee, hip, shoulders; the joints much swollen, puffed out by the liquid, are little or not at all painful, and voluntary movements are made with difficulty, but only by reason of the swelling;