urine was moderately coagulable, and below the normal quantity; its specific gravity, 1020. (Six leeches to the præcordia ordered; two grains of calomel twice a day, and a saline mixture, containing squill and digitalis.) She continued this plan of treatment until the 28th, when the præcordial pain had subsided. The heart's movements were lessened in force and frequency. The urine was copious, feebly coagulable, and its density, 1014. During convalescence, the anasarca disappeared, but the patient remained in a very anæmic condition, the urine increasing in coagulability until the 6th of December. From that date the coagulability became less, and speedily disappeared altogether.

(To be continued.)

ON THE DIAGNOSIS OF THE DIFFERENT KINDS OF MUSCULAR PARALYSIS.

By MARSHALL HALL, M.D., F.R.S., &c.

THE kinds of muscular paralysis, of which I propose in this paper to trace the diagnosis, are two—1, the *cerebral*; 2, the *spinal*.

I designate that *cerebral* paralysis, in which, by whatever means or disease, the influence of the *brain* is severed; and I designate that form of paralysis *spinal*, in which, from whatever cause, the influence of the *spinal marrow* is severed.

It is unnecessary to state, that in the latter case the influence of the cerebrum is removed, as well as that of the spinal marrow.

Before I proceed, I must take the opportunity of briefly alluding to the *functions* observed in the muscular system, for it is these that are variously affected in paralysis.

The first function of the muscular system which I shall mention is *voluntary motion*, the effect of *volition*; the second function, or rather affection of the muscular system, is the effect of *emotion*; the third is *reflex action*; the fourth is the *tone* of the muscular system; the fifth is the *irritability* of the muscular fibre. All these are wonderfully involved in every muscular act or action, though one may be principally so, and the affection of each becomes to the physiologist the source of diagnosis in cases of paralysis; for I may take this opportunity of stating, that—

In the diseases of the nervous system, the physiology is the diagnosis.

I will briefly detail the particulars of two cases, which may be taken as *types* of the rest.

The first was a case of hemiplegia, affecting the *right* side. The muscles of the right arm were paralytic, atrophied, and contracted, and rigid. We placed both hands in one basin, containing water with a little salt, and a foot in another, and we passed a galvanic current through the limbs so disposed, beginning with the *smallest* force which would produce an obvious movement. Invariably, in many trials, the paralytic arm was moved by the *slightest* force, and the most by a greater force, whatever the direction of the current.

The second case was that of a little girl, aged two years and a half, in whom the left arm had been suddenly affected with complete paralysis nearly two years before, the head having at the time of the seizure been drawn to one side, and the child being under the influence of dentition. In this case the paralysis of muscular power was, as I have stated, complete; the arm was atrophied, the muscles flaccid, the head moving on the wrist, if held in the dependent position, absolutely uncontrolled by muscular influence. We applied the galvanic test as before, using the *mildest* force which would produce an obvious effect. Now, the *unaffected* limb was first and most affected by the galvanism!

In these two cases we have the marked forms of *cerebral* and *spinal* paralysis respectively; in the first, we observe a very marked tone (contraction); in the second, abolition of tone, (flaccidity); in the first, we have augmented, in the second, diminished, irritability of the muscular fibre. In the first, too, there was agitation of the arm on any emotion; in the second, none. I had no satisfactory mode of testing the existence or absence of reflex action.

The physiologist, and now, I think, the practitioner, will see the value of these phenomena to science, and in their translation into diagnosis.

In hemiplegia, the seat of motion, the source of tone, the source of irritability, are *left*; in spinal paralysis, the seat of emotion, the source of the tone of the muscles, and of the irritability of the muscular fibre, are *removed*! It must be remembered, that in both cases the muscular mass was *equally atrophied*. What are the obvious physiological inferences from

these facts, and what are their practical advantages in a diagnostic point of view? I leave the replies to these questions to my readers, observing, that the first must be diametrically opposed to the opinions recently advocated by the late Dr. J. Reid, by Dr. Carpenter, Dr. Todd, &c.

The cases themselves, with many others, have all been witnessed by my friend, Mr. Henry Smith, of Torrington-square, and so frequently, and so carefully, that they may, I believe, be received as accurately ascertained facts, from which equally cautious inferences may be fearlessly drawn.

Are not these inferences—first, that the cerebrum is the seat of volition; second, that a lower portion of the encephalon (the medulla oblongata?) is the seat of emotion; third, that the medulla spinalis is the seat or source of tone or tonic in the muscular system? and fourth, of the irritability of the muscular fibre? and fifth, that the two last are *not* dependent nutrition merely?

Will not my readers pardon a little enthusiasm in the view I take of the value of these investigations, and a little indignation, not unmingled with contempt, at the treatment they have received at the hands of incapable opponents, at the Royal Society, and elsewhere? Can any ingenuous person read this simple narrative without deploring that *odium Physiologicum* which has met or persecuted this inquiry at every step?

I may here add that the cause of cerebral paralysis is, chiefly, the injured substance of the *cerebrum*; whilst spinal paralysis may arise from the injured substance of the *spinal marrow*, or from the injured substance or function of *spinal nerves*—any disease, in effect, which *severs* the influence of the spinal marrow from the muscles. In this sense the paralysis arising from *lead* is spinal paralysis. It is well known that in this disease the tone of the muscles and the irritability of the muscular fibre are diminished.

Of paroxysmal paralysis, and of algo- and spasm-paralysis, I have treated in recent papers in THE LANCET, to which I beg leave to refer my reader. I may observe here, that the hand and arm contracted by tone in cerebral paralysis are contracted symmetrically, and without distortion; all the muscles being equally affected: the flexors overcome the extensors, the arm is bent, and the hand closed firmly but regularly. In spasm-paralysis, *certain* muscles only are excited to contraction, and that contraction is irregular, clonic, and tonic, and the arm and hand are affected with various deformities, scarcely admitting of description, but which it would be highly interesting to depict.

Manchester-square, August, 1849.

Postscript; (being a Note on the difference between Tetanus and Hydrophobia.)

Hydrophobia, like the effects of strychnine, is *hæmatogenic*. The spinal marrow is in a state of abnormal and extreme excitability or erethism. But, as there is no permanent excitement, there is no spasm, except under the influence of an occasional one. There is perfect intermission of all spasmodic affection in the intervals between the paroxysms.

Tetanus, on the contrary, is *neurogenic*; and whilst the spinal marrow is equally in a state of undue excitability, there is a constant source of excitation in the injured, irritated nerve. There is, therefore, constant spasm, and remission only, in the intervals between the paroxysms—that is, in the absence of occasional excitants,—a paroxysmal exacerbation of spasm taking place when these are in operation.

Such is the grand pathological distinction between these diseases. I may make an additional remark: if in a case of tetanus the injured nerve was divided, the remittance of spasm would become intermittence. This view suggests the real value of amputation in such cases, discussed by Larrey and by Dupuytren, the former recommending, the latter dissuading from, this measure.

I may add, that hydrophobia having its source in the *blood*, its symptoms are uniform; there is always and equally laryngismus, whereas the symptoms of tetanus vary with the special nerve injured, and there is sometimes laryngismus, sometimes pharyngismus, sometimes not, as there is, in different instances, emprosthotonus, episthotonus, pleurosthotonus.

There is, further, the interesting question relative to tracheotomy in these diseases, and the not less interesting question, in a scientific point of view, of the morbid anatomy; with the latter object, I have devised an instrument for readily opening the cranium and spinal canal.

My reader will not be surprised, that with all these questions in my mind, I should meditate a journey as far as the seat of the Austrian and Hungarian warfare, with the view of observing tetanus in the wounded of those battle-fields.