

tion being formed between the scapula and the ribs, and in paralysis of the serratus magnus,—in all of which I have no doubt that, when the protrusion of the scapula is sufficiently great, the latissimus will be found to be displaced, although it will not be pretended, at least in the two former cases, that it was the original cause of the protrusion of the bone.

ART. XII.—*Observations on Marshall Hall's Theory of the Nervous System.* By ROBERT REID, M. D., Fellow of the College of Physicians of Ireland.

MY attention has been directed to some Lectures which have been published in the *Lancet*, by Dr. Marshall Hall, in which that physician claims to have been the first who undertook to point out the arrangement of the nervous structures in the animal body into three divisions, which, he says, he has distributed as having relation to three centres, viz., the cerebral, the spinal, and the ganglionic systems. I think it right to state, that *some years* prior to his statements on the subject, the medical public might have been acquainted with such a distribution of the nervous structures, by essays which I had published. These papers have been noticed by almost all the medical journals, both foreign and domestic, of the day. It is difficult to suppose how Dr. Marshall Hall could have avoided meeting with statements which bore such relation to subjects in which he seemed to be so much interested. I may mention, of these, a Treatise, by me, on Tetanus and Hydrophobia, which was published in 1817; and an Essay on Fever, which was published in the third volume of the *Transactions of the College of Physicians of Ireland*, in the year 1820.

Dr. Marshall Hall states, that his first memoir was published in the *Philosophical Transactions*, in June, 1833; and his second memoir, which was rejected by that learned body, was given to the public in 1837. In his anxiety for priority of publication, his *Lectures on the Nervous System*, published in 1841, he says were written in 1835.

From these evidences it appears clearly that Dr. Marshall Hall is not the first who promulgated the fact that the nervous structures in the animal frame are by nature distributed into three centres, to which all their influences are reciprocally referred. With these facts before his eyes, it is difficult to conceive how Dr. Marshall Hall could make an assertion that he was the first who stated these views of the nervous structures.

I should not have taken notice of these facts, but that the

want of a real acquaintance with the functions of each of these centres has led to the inextricable confusion with which these writings have obscured the simplicity of the subject. I may be allowed to make a few extracts from his book *On Diseases and Derangements of the Nervous System*, published in 1841.

In the third paragraph of the Introduction it is asserted that in the "*vis nervosa*" of Haller, the principles of motion were unknown to physiologists before the publication of Dr. Marshall Hall's discoveries. The human frame, although constituted of various systems, is one and indivisible: in order to accommodate this difficult and complicated subject to our limited understanding, he has found it necessary to proceed *analytically*! hence he speaks of the nervous, the respiratory, the digestive, the urinary, the uterine systems, as distinct objects of inquiry. And he asks:—"Is there in any class of animals a distinct *anatomy* of the excito-motory power? Are there excitor nerves distinct from nerves of sensation? Are there motor nerves distinct from nerves of volition?"

From considering these observations, it appears very plainly that this writer is obliged to notice the possibility of the existence of other nervous structures, which must be endowed with functions distinct from those centres which he has enumerated as having the power to influence the nerves which are distributed through the general frame. He states,—“In the first place, that the olfactory, optic, and acoustic nerves are nerves of sense only, and destitute of excito-motory power. So are the cerebrum and cerebellum, the former of which is probably the centre of the sentient and voluntary system. Is there a pure *voluntary* nerve?—a nerve which conveys the acts of the will without possessing the motor or excito-motory power? It appears to me that *one* such purely voluntary nerve may exist; for every muscle of the animal frame, with this exception, seems to require *tone*, which is a result of the excito-motory power, conveyed by motor nerves probably involved, in general, in the same *neurilemma* with voluntary nerves. This power acts during *sleep* in *all* muscles except the *levator palpebræ*, and perhaps the four *recti oculi*.

“But as there are purely sentient nerves, it may be a question whether there be purely excitor nerves. Such a nerve, probably, does not exist absolutely in health. An experiment made by Mr. Broughton, Mr. Field, and myself, in 1835, led to the conclusion that the *pneumogastric* nerve is destitute of sentient property. This nerve is certainly the least sentient, and the most purely excitor, of any in the class Ver-

tebrata. In certain cases of disease we, however, observe the sentient power annihilated, while the excito-motory still continues. This occurs in those diseases of the brain which destroy the sensibility of the face; the excito-motory property may remain, and the eyelash and the nostril be as susceptible of stimuli as ever. In the experiments in which the cerebrum, the *centre* of the sentient and voluntary system, is removed, and in diseases, and in other experiments, in which the upper part of the spinal marrow is disorganized or divided, the phenomena which remain are entirely of the excito-motory class. Sentient and voluntary nerves are blended with the excitor and motor nerves, but their functions are suspended when the influence of the centre of the system is cut off. The centre of the excitor and motor nerves being appropriate portions of the spinal marrow itself, the functions of these nerves remain.

"Still, the two sets of nerves are generally blended anatomically. If they be distinct in any class of animals, it is, probably, in the Invertebrata, and especially in their lowest forms, in which sensation and volition are nearly extinct, and the animal lives a sort of excito-motory life only.

"But if the existence of a *distinct* anatomy of the excito-motory system be doubtful, that of the *blended* anatomy, and that of the distinct physiology, pathology, and therapeutics of this system, are perfectly obvious."

"The cerebral system is separated from the true spinal, in hemiplegia, as frankly as in our best devised experiments."

The writer then stumbles upon what he calls a "most interesting phenomenon of the nervous system,—that of sleep. Deep and quiet sleep greatly removes the influence of the cerebral system, leaving the true spinal and the ganglionic in full action." "Not less so is that singular affection of the nervous system much allied to sleep, and repaired by sleep, termed *fatigue*. Both sleep and fatigue are affections of the cerebral system, and only remotely connected with the true spinal and ganglionic."

Has the writer any idea of what sleep is?

In the Table of the nervous system, the spinal system is stated to have for—

1. The principle of action, the *vis nervosa* of Haller.
2. Its modes of action are excited and reflex, or direct.
3. The reflex functions are those of—
  - (1.) Ingestion and Retention.
  - (2.) Egestion and Exclusion.
4. The direct functions are—
  - (1.) The tone
  - (2.) The irritability
 } of the muscular fibre.

This appears an example of want of accuracy in the use of terms, and, when considered along with other definitions to be noticed further on, will exhibit the most utter confusion of terms and functions.

The writer states, that "the designation cerebro-spinal is incorrect." And in the next paragraph it is stated:—"The cerebral system comprises every part of the nervous system which relates to sensation and volition, the nerves of *sense*, and the whole of the nerves of *voluntary motion*." Where is the spinal system in all this?

"The cerebro-spinal subdivision of the nervous system, or, as it would be more correctly designated, the cerebral, is the system of sensation and volition; it is that by which we feel and perceive external objects, and by which we approach them, and appropriate them to our use exteriorly." He then states, that the apparently simple operation of raising an object off the table requires three portions of anatomy, viz.:—

"1. Certain nerves must proceed continuously, uninterruptedly, *from the points of the fingers to the cerebrum*, the centre of this system.

"2. The cerebrum must be in a state of integrity.

"3. Certain nerves must proceed from the cerebrum to the muscles which are to be called into action.

"There are, then, two sets of cerebral nerves:" which assertion is absurd. And in paragraph 75 it is said to have been universally known that these nerves were nerves of sensation and nerves of motion. In a subsequent paragraph the author states, that "the aganglionic nerves are the voluntary or motive nerves."

From these extracts it would appear that, according to the arrangement of the nerves, the cerebral, the spinal, and now the ganglionic nerves, are to be considered as endowed with the functions of volition, and also of motion. In paragraph 106, the physiology of the cerebral system is said to "comprise sensation in all its forms: perception, judgment, volition, and *voluntary motion*." "It is obvious, then, that a sensation may lead to an act of volition or an action of emotion. These must be carefully distinguished."

"The distinctive character of voluntary motion is its spontaneous occurrence. Without sensation, without emotion, the individual *wills*, and a voluntary movement succeeds."

"Sleep is an affection of the cerebral system; it is *its* repose." The author here observes:—"The true spinal and the ganglionic systems never sleep. They only feel the *effect* of sleep in removing the participating agency of volition in some of the excito-motory acts, especially in that of the respiration."

Has he never met an essay on Dreaming by the late Andrew Carmichael, which was published in the Transactions of the College of Physicians of Ireland, where it is clearly proved that sleep is caused by the process of renovation of the parts which have been in action, and require the removal of the particles which have had their function exercised? How therefore can sleep be considered the repose of the brain, when it is so busy in appropriating the fresh particles necessary to enable it to continue its functions? This circumstance occurs in all the three systems with the same effect, and therefore it cannot be asserted that the true spinal system, and the ganglionic system, never sleep.

"Another *function* of the cerebral system is the sense of fatigue."—Is fatigue a function? And how can the *character* of voluntary motions, as stated in paragraph 117, be that of being frequently *spontaneous*?

"The true spinal or excito-motory system involves a system of incident and reflex nerves, connected with the true spinal marrow as their centre." It seems difficult to understand what the writer means by the term *reflex nerves*. In some places he seems to think there are nerves for the purpose of conveying impressions towards the centre of the system, while others are devoted to convey impressions from the centre to the parts to be acted on, thus implying the existence of two sets of nerves, which he has not been able to demonstrate. Were the author, however, acquainted with the fact, that the nerves only perform their functions at their sentient extremities, he might perceive there could be no necessity for the complicated structures which he supposes. How usual is it for patients who have suffered amputation to complain of pain in parts of the amputated limb.

In the "*anatomy* of the true spinal system," a statement is made, that a new kind of action of the *vis nervosa* has been demonstrated, and, physiologically speaking, a new kind of nerve; that is—

I. An incident motor action; and—

II. An incident motor nerve.

Although this is said to be a *demonstrated fact*, it has been well stated by him, that this is not to be found in the works of any other physiologist.

"By the cerebral system we are placed in relation to the external world, psychically or mentally; by the true spinal system we are placed in a similar relation physically. As by the former we imbibe all our ideas, so by the latter we appropriate external objects to our very substance. On the true spinal system, all ingestion, all retention, all expulsion, in

regard to the animal frame and economy, depend." To this statement, the author's own observation appears most applicable,—“It is impossible to argue with persons of such confusion of ideas.”

“As the true spinal system governs the ingestion and egestion of masses, in regard to the animal economy, so the ganglionic system regulates the interstitial absorption, deposition, re-absorption, and the secretion of the atoms or particles of which the animal body is composed, and of the ingesta and egesta.” “It was to be expected, therefore, that there would be an external as well as internal ganglionic and nutrient system. This we find accordingly, although it has never been so viewed or stated before. “There is an internal nerve for formation, nutrition, secretion, &c.; this nerve is ganglionic. There are external organs and structures requiring nutrition, &c. There are also external ganglionic nerves.”

I have thus made a few extracts from Dr. Marshall Hall's book on Diseases and Derangements of the Nervous System, published in 1841. They may afford evidence of the inextricable confusion in which the statements throughout his book have enveloped all the simple operations relating to the physiology of the human frame. If Dr. Marshall Hall understood the real powers of the three systems into which the nerves are naturally distributed, he would not be seeking after other systems which do not exist in nature.

The ganglionic system is that by which particles are assimilated to the supply of the animal body, and which particles, having performed their destined office, become unfit for any further appropriation. The spinal system is the regulator of all kinds of motion in the animal frame; and the cerebral system, by means of the senses, preserves the individual in relation with the external world. By means of its influence internally, the different organs make choice of the principles derived from the food, &c., fit for assimilation in each peculiar structure; and by means of the intellectual functions the human body is held in relation with the immortal soul. Thus all the actions of the animal frame can be resolved into assimilation of foreign particles; the moving powers to convey these particles to the different parts requiring their presence; and deposition of these particles upon the parts requiring them by the influence of the cerebral system. To this simple distribution of the nerves, all the actions of the animal frame may be referred, while life continues. And I may observe here, that they govern the animal body in the most complicated structure, as well as in the most simple and least complicated organization of life.