

the eye or ear, will excite the hydrophobic gasp and convulsions; it will also excite a conservative act: the patient, when water is presented to him, is horrified, and immediately attempts to remove it. This movement is strictly involuntary, and not the result of sensation; the water is repelled from the lips with a violent spasmodic jerk, and often in spite of the urgent volitional attempts of the patient to the contrary, just as the hand is snatched away from a spark of fire, or the headless frog leaps from the needle. I have already shown that acts strictly involuntary are simply reflex acts, accompanied with sensation, and that consciousness does not invalidate their character. By what channel then can the idea of drinking, originated in the brain by the presence of water, act upon the respiratory muscles, so as to induce gasping, and upon the excitor-motor nerves of the head and arm, so as to excite the convulsive removal of the offered cup of water?

The cerebral nerves being analogous to the posterior spinal nerves, and the encephalic ganglia analogous to the spinal ganglia, the spectrum of the cup of water will traverse the optic nerves, and enter the analogue of the posterior gray matter in the brain causing changes, (idæogenous changes,) corresponding to the idea of water; thence the series of excited changes will pass over to the analogue of the anterior gray matter exciting another series, (kinetic changes, *κινητικός*), by which the necessary groups of muscles are combined in action. If the cerebral ganglia be but a higher development of the spinal, the medullary and cortical substance must correspond to the white and gray matter of the cord, and if it be acknowledged, (as has indeed been proved beyond question,) that a combined action of sets of muscles, exhibiting a design of conservation, may be developed in the spinal cord without the aid of volition, how can we deny the same qualities to the encephalic ganglia, or in other words, to the cerebral hemispheres and their connexions?

We must consider then each half of the encephalon as consisting of two tracts of cortical, and two of medullary substance; the medullary associating ideas and combining muscular movements; the cortical, conducting impressions to the gray matter, giving rise to sensation and perception, and thence to the muscles, exciting motion. That impressions received by the sensitive nerves excite trains of ideas is generally acknowledged, and that the ideas constituting these trains have a connexion with the elementary constitution of the brain is clearly inferrible from the numerous observations recorded, in which the memory has been only partially abolished, as for example in the case recorded by Dr. Abercrombie. In this instance, a lady had lost the recollection of ten or twelve years only; every thing previously to that time she remembered quite well, all else she had forgotten. Indeed, since an infinity of muscular acts are already inscribed within the structure of the anterior gray matter of the spinal ganglia, and require only the appropriate sensory impression to rouse them into action, so ideas may be inscribed, and require only sensory impressions to rouse them. The posterior gray matter, or its analogue in the brain may then be considered as the seat of associations and trains of ideas.

It will be scarcely necessary for me to state in detail, after the preceding remarks, the facts and arguments which may be adduced to prove that the brain, (comprising cerebrum and cerebellum,) is an excitor of reflex acts. Dr. Marshall Hall has relied mainly upon the experiments of Professor Flourens in support of his opinion that the brain is inexcitator, but it will be seen that these experiments consisted simply in irritating the brain by pricking and tearing. Professor Flourens found that if the central axis be irritated mechanically from above downwards, beginning with the hemispherical ganglia or brain, that no spasmodic motions are excited until the tubercula quadrigemina be touched; it is on irritating that point that excito-motory phenomena first appear, and from that point downwards to the cauda equina, they may be produced by mechanical stimulants. Reflex acts do not, however, consist in convulsive movements of the muscles only, nor are they produced most distinctly in the mode adopted by Prof. Flourens. Such irritations differ altogether from even the tactile sensations received by the general surface. As every nerve has its proper endowments, and requires the irritant peculiar to itself, to develop the reflex phenomena indicative of design, so the sensory gray matter in which the sensual nerves end must have its proper endowments and peculiar stimuli. Now, no pricking or tearing could induce these changes that depend on the undulations of an elastic medium. The irritant must be much more closely assimilated to the normal excitation. From Dr. Stilling's researches

we know that strichnine is an efficient excitant to the gray motor track, and it is more than probable that a skilful application of narcotics to the sensory track in the encephalon of frogs might lead to important results. There are two modes in which the centric excito-motor phenomena of the brain may be studied: first, by considering the action of narcotics circulating with the blood through the brain, as Dr. Hall has considered the phenomena of hydrophobia and asphyxia; and secondly, by analysing the centric phenomena dependent on functional derangements of the encephalon. Examples of both kinds are numerous; of the latter class is the singular case observed by Mr. Wood, and as it is an undoubted example of cerebro-spinal reflex acts, and illustrative of my previous remarks, as to the centric excitation of ideas and combined movements, I shall analyse its principal phenomena. The patient was a young married female nursing an infant aged 14 months. She first had a painful affection of the right side of the face, pains darting from the cheek to the temple and teeth; the incident excitor branches of the fifth were affected. In two or three days, the excito-motor branches going to the orbicularis and levator palpebræ, were implicated, for an involuntary motion of the eyelids then commenced, in which they were opened and shut with excessive rapidity for about fifteen minutes. Then the excito-motor spinal nerves of the right side were implicated, for the movements of the eyelids were instantly succeeded by involuntary motions of the right leg and arm, continuing for about ten minutes. The motions then intermitted for about ten minutes, and recommenced in all the extremities with increased violence. But these movements were not mere spasmodic or convulsive jerks; groups of muscles were brought into action. The palms of the hands beat rapidly on the thighs, and the feet on the ground. The forearms were rubbed incessantly along the thighs, and the radius rotated on the ulna. The arms were at times extended, and the palms turned outwards. Next day the muscles of the trunk were affected, and the patient was suddenly raised from the chair, and as quickly reseated. The motions of the eyelids were followed by vomiting, showing that the centric change had extended to the pneumogastric ganglia. The next day the consentaneous action of groups of muscles were still further extended; the centric changes evidently making progress upwards, for in addition to the previous motions she was now jerked from side to side of the couch chair on which she sat; she had often a sudden propensity to leap upwards, and was impelled into every corner of the room, striking the furniture and doors violently with the hand. Here decided marks of design appear in the movements. On the following day the acts had become rhythmical, and the centric changes had evidently arrived at some portion of the encephalon connected with the idea of time; she frequently danced upon one leg, and in the evening the family observed the blows upon the furniture to be more continuous, and to assume the regular time and measure of a musical air. As a strain or series of strokes was concluded, she ended with a more violent stroke, marking the time. The next day, the centric change had ascended higher. The rhythmical movements had become more complex, and changed into a graceful dance. But the changes had now reached the idea of space as well as of time, for occasionally all the steps were so directed as to place the foot constantly where the stone flags joined to form the floor, particularly when she looked downwards. An analogous result occurred when she looked upwards; she then had an irresistible propensity to spring up and touch little spots on the ceiling. In both these movements the optic nerve exhibited an incident-excitor function. The tune was now discovered that she danced to; it was the air of the "Protestant boys," popular in the neighbourhood, and she informed Mr. Wood that there was always a tune dwelling upon her mind, which at times becoming more pressing, irresistibly impelled her to commence the involuntary actions. The centric changes here ceased, which had induced this alteration of sensory function, and which had reproduced in fact the idea of the air with such force that it impinged on the motor track, and there excited consentaneous reflex acts, in spite of the utmost volitional effort of the individual. The motions were stopped by interrupting the action of the excitor (the musical air) on the motor track, for so soon as the time was broken, or a continued roll played on drums, the motion ceased. The patient had several relapses; the eyelids and muscles of the face were only affected in some of these, in others, the muscles of the chest, larynx, neck, and back. In one attack she rotated swiftly.

Having traced the progress of the symptoms of this case, I need