

or the principal organs of this great function is contradicted by their anatomical connections, from which it follows that they are rather presiding organs (*Schalt organe*) of certain parts of the brain than the principal bonds of connection of the brain with the whole motor apparatus.

We must therefore seek in another place for the central organ of the bodily movements. The origin of muscular movements, which as regards physiological function stands next to mentalization, would bespeak the largest portion of the central nervous system after the cerebrum. These considerations induced Dr. Adamkiewicz to seek in the cerebellum the central organ for bodily movement. Laborious experiments, begun in 1900 and now concluded, have confirmed these suppositions and led to the following conclusions.

The cerebellum is the main organ of movement, as the cerebrum is the main organ of the mental function. The destruction of the cortex cerebri puts an end to the mental functions without altering the motor mechanism injury to the cerebellum suspends the whole function of movement without harming the psychical function; and as there are especial functional areas in the cortex so there are especial areas in the substance of the cerebellum for particular combined movements. As on the surface of the hemispheres there is a localisation of the mental function, so there is on the surface of the cerebellum a localisation for motor functions, motor centres for the head, the trunk, and the extremities. These centres have a separate and fixed situation. They are on the same side as the muscular groups to which they transmit impulses. The muscles of the extremities are represented in the cerebellum with triple centres. Each anterior and posterior extremity has its own motor centre, and there is another for these two combined, besides a common centre for all the four limbs. The whole four are therefore represented in the cerebellum by seven motor centres. These views the Professor proposes to demonstrate in a coming work.

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(¹) "Die Pathologie des Gehirns," *Sitzungsber. d. k. Akad. der Wissensch. zu Wien. Math.-naturw. Cl.* lxxxviii. S. 113 ff.—(²) *Die Funktionsstörungen des Grosshirns.* Berlin, 1898, Hans Th. Hoffmann.

On Localisation of the Functions of the Cerebellum [*Saggio di localizzazioni Cerebellari*]. (*Riv. de Pathol. Nerv. e. Ment.*, May, 1904.) Pagano, G.

Dr. Joseph Pagano has also been investigating the functions of this structure which has so much perplexed physiologists. He observes that Weir Mitchell was the first to show that the cerebellar cortex responded to artificial stimuli. Nothnagel came to the conclusion that excitations of the cerebellum provoke muscular contractions on the same side of the body, and Ferrier demonstrated the existence of pains which influenced the movements of the eyes as well as of the head, limbs, and pupils. Mendelssohn, using weak electrical currents, was unable to confirm Ferrier's localisation, but he found that electrical excitation of the cerebellum provoked movements of the eyes and of some other parts of the same side of the body. Arguing from the well-observed influence of lesions of one side of the cerebellum on the same side of the body,

Dr. Pagano regarded this as a proof of cerebellar localisation, and proceeded to make some experiments on dogs with a view to gain further and more precise knowledge. His method of research was to inject from one to two tenths of a cubic centimetre of a one *per cent.* solution of curare into certain points of the cerebellum. For this he uses a small trephine and a fine injecting needle. His experiments are illustrated by eleven plates.

Dr. Pagano discovered an area of the cerebellum from which tonic flexures of the hind legs could be induced. This was a point about the middle of the vermis. The character of the movements differed from that following excitation of the motor areas of the cortex cerebri. The injection of the same solution of curare in the cerebral motor centre and the action of curare on the surface of the motor zone provoked clonic contractions of the limb, abrupt and spasmodic. On the other hand, the injection of curare into the area of the cerebellum produced a tonic contraction, an attitude rather than a movement, which in some cases might endure for several minutes and return at intervals during several hours. This contraction has all the characters of a contracture, save that it may be suspended by a voluntary effort.

Dr. Pagano considers that his researches warrant him to affirm :

1. That the cerebellum is not a homogeneous organ ; but, like the other nerve centres, the different modes of its activity are exercised by precise and distinct areas.
2. The centres which he has discovered are without doubt not the only ones. It will be the task of successive observers to fix the seat of other centres correlated to other muscular groups.
3. The motor elements do not appear to be situated on the surface of the organ, but lie deeper.
4. There are centres the irritation of which always causes psychical exaltation. These can be sufficiently localised.

Dr. Pagano explains this psychical exaltation as a state of extreme restlessness, irritability, and an unusual readiness to react to slight impressions. This exaltation in most cases passes away in from ten minutes to half an hour, when it is succeeded by generalised epileptiform convulsions, after which the animal falls into an apathetic state. Dr. Pagano cites a passage from Luciani in which that eminent physiologist states his hesitation in excluding the cerebellum from all participation in the phenomena of psychical life. Pagano notes that intellectual decay frequently follows disease of the cerebellum in human beings. The author does not escape from the difficulty, common to all who have investigated the function of this organ, of giving a clear definition of their results in accordance with their observations. He, however, boldly advances that, after eliminating some faulty observations, all the data furnished by the physiologists and the clinical observers who have studied the functions of the cerebellum, far from contradicting, support and complete one another, and agree with his own researches. The facts which support the view that the cerebellum regulates the equilibrium of the body do not clash with those which indicate that this organ dispenses a force destined to raise the tone of the neuro-muscular apparatus.

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