

XXV. *On the Connexion of the Anterior Columns of the Spinal Cord with the Cerebellum.* By SAMUEL SOLLY, Esq. Lecturer on Anatomy and Physiology at St. Thomas's Hospital. Communicated by P. M. ROGET, M.D. Sec. R.S.

Received April 26,—Read May 19, 1836.

THE following observations have been drawn up with the view of communicating to the Royal Society an anatomical fact of considerable importance in relation to physiology; and the author hopes that its promulgation will assist the labours of those who are now engaged with researches into the functions of the central division of the cerebro-spinal axis of the nervous system in Man.

In relating this fact it has been deemed unnecessary to dwell at length on the important inferences which may be drawn from it, or to preface it with many introductory observations.

One of the few clearly established principles regarding the functions of the nervous system, and for the discovery of which we are indebted to Sir CHARLES BELL, is that the anterior roots of the spinal nerves are conductors of volition to the voluntary muscles, and the posterior roots of the same set of nerves conductors of sensation from all parts of the body. This fact once clearly established, it follows as a consequence that the anterior and posterior portions of the spinal cord must perform a similar office to the anterior and posterior roots of the nerves connected with them, in consequence of the continuity of the filaments of neurine which compose them. And though the exact line of demarcation between these two tracts, for volition and sensation, in the spinal cord has not yet been ascertained\*, we are all equally interested in the following inquiry, With what portions of the brain are they connected?

It cannot be disputed that more accurate knowledge on this point would afford us a better clue to the respective office of the grand divisions of the encephalon than any other. Some physiologists even in the present day have argued that the office of the cerebellum must be immediately connected with the phenomena of sensation, from erroneously supposing that the tracts of sensation are alone continuous with its structure.

Anatomists when engaged in studying the relations of the spinal cord to the cerebral mass, have generally pursued the dissection from below upwards, on account of the great facility of tracing its fibres in that direction. In so doing they have hitherto

\* From several facts, which it is unnecessary to mention at present, I have little doubt that each side of the cord is equally divided into a motor and a sensory tract, the anterior half being appropriated to volition, the posterior to sensation.

followed the anterior and lateral columns of the cord solely to the cerebrum, and the posterior columns exclusively to the cerebellum. Consequently the corpora restiformia or processus e cerebello ad medullam oblongatam have been described as consisting entirely of fibres from the posterior columns\*.

The author having been able, by repeated dissections of the brain previously hardened by long-continued immersion in alcohol, to satisfy himself of the existence of certain fibres, which have hitherto escaped observation, ascending from the antero-lateral columns of the spinal cord to the cerebellum, will proceed to detail their course and arrangement.

In order to execute this portion of his task with clearness, he feels it necessary to refer to the composition of the cord, as demonstrated by a transverse section. It will then be seen that the cineritious neurine deposited in the interior of the cord is arranged on each side, so as to form two semicircles, with their convexities opposed,

and attached by a transverse bridge thus,  the posterior peaks alone reaching

the surface of the cord. This last-mentioned arrangement of the gray matter, it will be seen, actually divides each side of the cord into two distinct columns. The posterior portion is the true *posterior column*, and the line of demarcation is distinct on the surface without a transverse section, in consequence of the posterior roots of the spinal nerves emerging at that point. All that portion of the cord which is anterior to this posterior lateral fissure not being divided in a similar way may be called the *antero-lateral column*.

From the antero-lateral column of the cord there are two sets of fibres ascending to the cerebellum, one from the anterior portion of the antero-lateral column, the other from the posterior. The posterior set of fibres are separated from the posterior columns by the posterior peaks of gray matter; and judging from the fact that the sensory division of the fifth pair of nerves is continuous with these fibres, it appears most probable they form part of the sensory tract. See Plate XXXVIII. fig. 2. 1.

The anterior set, the *cerebellic fibres of the anterior columns*†, proceed from the front and sides of the cord, continuous therefore with the true motor tract. A portion of them may frequently be seen without dissection, and have been adverted to by several writers under the title of arciform filaments, though their termination in the cerebellum remained undiscovered. See fig. 1. E.

These *cerebellic fibres of the anterior columns*, opposite the decussation of the py-

\* Mr. HERBERT MAYO is, I believe, the only author who points out the fact that the restiform bodies are partly formed by some fibres from the posterior part of the cord, but anterior to the posterior lateral fissure, and therefore not solely by the true posterior columns. In the second edition of his *Outlines of Physiology*, p. 273, he says, "On cutting through and stripping down the corpus restiforme, it is found to carry with it the posterior lateral furrow."

† The fibres whose existence this paper is intended to demonstrate.

*ramidal bodies*, are separated from the posterior fibres of the antero-lateral columns, already described as ascending to the cerebellum, by fibres which occupy a place in the middle of the side of the cord. These fibres, which subsequently ascend through the pons Varolii to the cerebrum, and form the upper portion of the crus cerebri, have lately been described by Sir CHARLES BELL as a portion of the tract of sensation. The *cerebellic fibres of the anterior columns*, as they ascend to the cerebellum, pass principally below the olivary bodies, sometimes crossing the lower border of these bodies, while others which are deeper seated pass to the inner side of them. The whole, during their ascent to the cerebellum, cross to the outer side of the tract of sensation above referred to and sensory root of the fifth pair of nerves, and then, plunging into the substance of the corpus restiforme, interlace with the true posterior columns of the cord, and finally terminate in the cerebellum. See fig. 2.

These fibres, whose importance to the physiologist as proving unequivocally the existence of a complete communication between the motor tract of the spinal cord and the cerebellum need not be dwelt on, are most easily demonstrated in the following way: Let the posterior column be separated from the antero-lateral column, at the posterior lateral fissure, about two or three inches below the pons Varolii; and subsequently draw very carefully the posterior column, thus split from the anterior, up towards the cerebellum. The rent in the cord, which tears smoothly till it reaches the lower edge of the corpus restiforme, is there arrested by the *cerebellic fibres of the anterior columns*, unless too much force has been used, in which case they are easily torn through, and escape observation. They may be likewise shown by making the rent in the antero-lateral column itself, exactly at the centre of the lateral face of the cord, thus dividing the cord into two halves, an anterior and a posterior, and then continuing the rent in the same way. Again, these fibres may be shown by tearing up that portion of the front of the cord which is anterior to the anterior roots of the spinal nerves, which portion will be found, at the point where the anterior columns decussate, to split into three sets of fibres: one set of fibres cross to the opposite side; a second run to the inner side of the corpus olivare; a third set, which are not numerous, run below and to the outer side of the corpus olivare, and, ascending to the cerebellum, constitute a portion of the fibres in question.

If the sensory root of the fifth pair of nerves be traced through the pons Varolii, and the fibres which lie to the outer side of it in the medulla oblongata examined with care, they will be found connecting the anterior portion of the cord with the cerebellum; or, in other words, they will be found to be the *cerebellic fibres of the anterior columns*. The surface of these fibres is represented in fig. 1. E. as exposed by simply raising the pia mater, and carefully scraping the surface in a portion of the medulla previously hardened by alcohol. The deeper-seated are represented divided just at the point where they cross the sensory root of the fifth pair of nerves, which nerve is thus exposed to view in fig. 2. E. the corpus olivare having been raised from its natural position.

*Description of the PLATE.*

PLATE XXXVIII.

Fig. 1. represents the medulla oblongata, pons Varolii, and a portion of the cerebellum.

The following letters refer to the same parts in both figures.

- A. Pons Varolii.
- B. Cerebellum.
- C. Corpus pyramidale.
- D. Corpus olivare.
- E. The cerebellic fibres of the anterior columns running up to the cerebellum, and forming a layer on the corpus restiforme, or processus e cerebello ad medullam oblongatam.
- F. Sensory root of the fifth pair of nerves running through the pons Varolii, of which a section has been made to expose it.
- G. Anterior root of one of the spinal nerves.
- H. Posterior root of one of the spinal nerves.

Fig. 2. represents the medulla oblongata and pons Varolii.

The following letters refer alone to Fig. 2.

- C\*. Decussation of the anterior columns.
- I. Fibres of the corpora restiformia derived from the posterior columns.
- K. Antero-lateral columns.
- L. Posterior columns, separated from the above by
- M. The posterior peaks of cineritious substance.

