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"The Origin and Destination of certain Afferent and Efferent Tracts in the Medulla Oblongata." By J. S. RISIEN RUSSELL, M.D., M.R.C.P., Research Scholar to the British Medical Association, Senior Assistant Physician to the Metropolitan Hospital, and Pathologist to the National Hospital for the Paralysed and Epileptic, Queen Square, London. Communicated by Professor VICTOR HORSLEY, F.R.S. Received February 18,—Read March 11, 1897.

(Abstract.)

In attempting to arrive at definite conclusions with regard to the origin and destination of some of the afferent and efferent tracts which exist in the medulla oblongata, the following experimental procedures were adopted.

1. Section or destruction of the lateral region of the medulla between the ascending root of the fifth nerve and the inferior olive.
2. Division of the restiform body.
3. Division of the direct sensory cerebellar tract of Edinger.
4. Severance of Deiters' nucleus from its connections with the medulla.
5. Section of the posterior columns and their nuclei in the medulla.

The first of these procedures was followed by degeneration of two efferent tracts which could be traced throughout the whole length of the spinal cord, the one occupying the antero-lateral region, and the other being closely related to the crossed pyramidal tract, as regards position. In addition to this, afferent fibres degenerate from the seat of lesion, some of which pass to the cerebellum by way of the restiform body, others course through the medulla and pons external to the superior olive and on the ventral side of the emergent roots of the seventh and fifth cranial nerves to eventually reach the middle lobe of the cerebellum by way of its anterior peduncle. Situated internally to the tract just described is another bundle of more scattered fibres, close to the outer end of the fillet, with the fibres of which system they remain intimately associated in their further course towards the mesencephalon, and can be traced to the region of the anterior corpora quadrigemina. Owing to destruction

of a large number of the arciform fibres by the lesion, degenerated fibres were traced to the opposite inter-olivary layer, and well marked degeneration of the opposite fillet, consequent on this, could be traced to the region of the corpora quadrigemina. So too, fibres passing to the inferior olives were interrupted by the lesion, and degenerated in consequence.

Division of the restiform body, unattended with accidental complication, resulted in degeneration of afferent fibres to the cerebellum, and of efferent fibres to the formatio-reticularis, and the inferior olives; no tract in the spinal cord being found degenerated after this lesion.

In dealing with the results of section of the direct sensory cerebellar tract it is insisted that this structure ought to be regarded as totally distinct from the restiform body, and it is further pointed out that it is most difficult to sever this connection of the cerebellum without injury to Deiters' nucleus, which is imbedded in the fibres of this tract.

No efferent tracts were found degenerated other than those consequent on injury to Deiters' nucleus, and no afferent fibres were found degenerating from this nucleus to the nucleus globosus in the cerebellum.

Severance of the nucleus of Deiters from its connections with the medulla resulted in degeneration of an efferent tract passing through the formatio-reticularis of the same side of the medulla, to form a well marked antero-lateral tract on the same side of the spinal cord, extending to the lumbo-sacral region. Other degenerated fibres pass to both posterior longitudinal bundles, and others beyond these structures to terminate in the opposite formatio-reticularis. Of those which enter the posterior longitudinal bundles, some have a caudal course and reach the anterior columns of the spinal cord, on both sides, to terminate in the lower cervical region; while others pass cephalwards and can be traced to the region of the quadrigeminal bodies, where they appear to terminate. Some degenerated fibres pass from the seat of lesion across the raphe to the region of the opposite superior olive, some of them appearing to enter this structure, while others become intimately associated with the opposite fillet, and pass with this structure to the region of the anterior corpora quadrigemina.

Section of the posterior columns and their nuclei in the medulla was performed with a view to control certain of the other experiments, but it was found that beyond degeneration of fibres passing to the cerebellum in the restiform body, and of the arcuate fibres to the opposite interolivary stratum, with consequent degeneration of the opposite fillet, none of the degenerations previously described in connection with the other lesions were met with.

In view of certain recent experimental observations responsible for calling into question the existence of a direct anterior pyramidal tract, evidence is adduced in support of the existence of this structure; and the various direct efferent tracts met with in the spinal cord are fully discussed.

Among the conclusions based on the results of this experimental inquiry, the following are to be found:—

1. The descending antero-lateral tract, which degenerates in the spinal cord after a lesion of the lateral region of the medulla, is probably the same as that met with after injury to Deiters' nucleus, and is probably identical with that described by Marchi as degenerating after lesions of the cerebellum, Mott after injury to ground fibres and some of the cranial nuclei, and Biedl after section of the restiform body, its real source of origin being Deiters' nucleus, as contended by Ferrier and Turner.

2. The degenerated fibres which reach the anterior columns of the upper part of the spinal cord through the posterior longitudinal bundles, after a lesion of Deiters' nucleus, are quite distinct from the above tract, and probably belong to some system of internuncial fibres similar to those traced by Boyce to the anterior columns of the spinal cord, by way of the posterior longitudinal bundles, after hemisection of the mesencephalon.

3. The direct descending tract of degenerated fibres met with in the spinal cord in close relationship to the fibres of the crossed pyramidal tract, after a lesion of the lateral region of the medulla, is probably identical with a similar tract described by Boyce after hemisection of the mesencephalon, and by Biedl after section of the restiform body and ascending root of the fifth nerve; the proximity of Boyce's columnar tract to the latter structure accounting for its probable inclusion in Biedl's lesion.

4. Fibres derived from the restiform body proper, and degenerating caudalwards after section of this structure, do not form an efferent tract in the spinal cord.

5. There is no evidence that the "direct sensory cerebellar tract" of Edinger is composed of afferent fibres, but, on the contrary, it appears to be an efferent tract from the nucleus globosus to the nucleus of Deiters, as suggested by Ferrier and Turner.

6. One of the afferent tracts met with after a lesion of the lateral region of the medulla corresponds so closely in position and distribution with the afferent antero-lateral tract of Gowers that it is highly probable that they are identical, and accordingly that the observations of Mott and of Auerbach are correct in this connexion.

7. Another efferent tract which degenerates after the lesion of the lateral region of the medulla, and which is related to the fillet in its course to the region of the quadrigeminal bodies, is probably the

same as that described by Mott as a distinct part of the antero-lateral tract of Gowers, and is certainly no artifact, as has been suggested by Patrick.

“On the Orientation of Greek Temples and the Dates of their Foundation derived from Astronomical Considerations, being a Supplement to a Paper published in the ‘Transactions of the Royal Society,’ in 1893.” By F. C. PENROSE, F.R.S. Received February 24,—Read March 11, 1897.

(Abstract.)

The paper first states briefly the link which connects this branch of archæology with astronomy, namely thus :—The great temple functions were celebrated at early dawn, the principal annual function being on the day when the sun, rising above the visible horizon, shone along the axis of the temple, through the eastern door, upon the Statue of the Deity in the sanctuary, the axis of the temple having been so directed at its foundation—an institution which seems to have originated in Egypt, but which was, from the earliest times, adopted in Greece. But as some time was required by the priests for preparation for the ceremony, in the absence of clocks, the rising or setting of an heliacal star would have to be observed from the sanctuary to give warning of the sun’s approach; and it would be the case, roughly, that when such star could be just seen either at its appearing in the east, or just before its disappearance in the west, it would give about an hour’s time for preparation. The data for the calculation are: the latitude, the amplitude given by the direction of the temple’s axis and the altitude of the visible horizon. From these the sun’s right ascension and declination are deduced, then the place of a star having been found suitable for acting as a warning star—which could not have been always possible without original contrivance—the precessional movement of such star will then give the period which has elapsed since it was in accurate heliacal correspondence with the sun.

In the paper are recorded some observations of the heliacal visibility of stars chiefly before sunrise, and the different angles of solar depression which seem to me to be required for stars of different magnitudes, and particularly as to the visibility of the Pleiades in twilight.

Then the elements of orientation of a number of temples are given, viz., four from Athens, which were not included in the former series, a new determination of the ancient Heræum near Argos, the former having been taken before the site was completely cleared; of the temple of Apollo at Delphi, of which the site is very