

investigation of the communities that they form, and of the interlocking of these into greater, more complex communities; a study of the external configuration of individuals, with reference to their resistance to undue humidity, undue dryness, unusual cold, extreme heat; an anatomical study of their several organs as connected with the same factors; a chemical study of their secretions in the same light; and, finally, a return to that with which I began, a study of their protoplasm in all its phases.

Anatomy: What is the Morphologic Status of the Olfactory Portion of the Brain? PROFESSOR BURT G. WILDER.

IN view of the multitude of problems now confronting anatomists,* it has seemed to me that the present occasion may be best utilized by discussing, in some detail, a single topic which has, nevertheless, intimate relations with several others in anatomy and embryology, human and comparative. Most of the points are indicated upon the wall-maps exhibited.†

Stated more specifically, does the olfactory

*In 1894 I stated (Records of the Association of American Anatomists, sixth meeting, p. 32) that, in addition to about fifty special questions respecting each of the fifty particular cerebral fissures, there are at least one hundred general problems connected with them as a group of features of what is commonly mentioned as a single organ.

†These included diagrams of the brains of man, sparrow, turtle, *Necturus*, *Ceratodus*, *Scymnus* (after T. J. Parker), *Chimæra*, *Polyodon*, *Petromyzon* and *Bdellostoma*: a diagram of the mesal aspect of the human thalamus, etc., exhibiting the location of the aulix ('sulcus Monroi') as first described by Reichert, together with the deflection of its cephalic half as proposed by His; and schemas representing (a) the dorsal aspect of the six definitive segments now recognized by me; viz.: Rhinencephal, Prosencephal, Diencephal, Mesencephal, Epencephal, Metencephal; (b) the same as if medisectioned; (c) the several brain flexures, especially the diencephalic; (d) the five different topographic relations to the general axis of the brain (as represented by the olfactory crus) of the presumed psychic expansions.

portion of the brain constitute a definitive segment; or does it, together with the striatum and pallidum, constitute merely the 'dorsal zone' of a segment whose ventral zone is the 'pars optica hypothalami,' i. e., the region about the chiasma?

As a basis for the consideration of this question are offered the following propositions, the validity of which each must determine for himself:

1. We must distinguish between the *potential neuromeres*, the precise number of which may not be determined for decades, and the *definitive segments*, which are convenient and natural divisions, even if not all of equal morphologic value.

2. For the determination of the segmental constitution of the brain more reliance is to be placed upon comparative anatomy and embryology than upon the structure and development of that morphologic monstrosity, the human brain.

3. The recent enactments of the Anatomische Gesellschaft upon this subject (B. N. A., 1895) are based almost exclusively upon the conditions in a single member of the vertebrate community, man; at the best, even if they apply more or less closely to the other mammals, they constitute an example of 'class-legislation.'

4. When a writer employs a term in a sense other than either (a) that which is generally accepted, or (b) that in which it was first introduced, or (c) that in which it is used by other writers whose views he may be discussing, it is incumbent upon him to state explicitly the sense in which he proposes to use it.

The present obstacles to the recognition of a rhinencephalic segment are three, viz.: (1) The common impression as to the insignificance of the olfactory region. (2) The existence, in the higher vertebrates, of the modification designated by me as the diencephalic flexure. (3) The adverse view adopted in the B. N. A., based largely upon the assumption that the region

cephalad of the mesencephal comprises dorsal and ventral zones demarcated by an alleged sulcus connecting the mesoceles with the *recessus opticus*.

1. Doubtless all members of this society have discarded the anthropotomic estimate of the olfactory bulbs and their crura as constituting merely a 'first pair of cerebral nerves.' But not all, perhaps, fully realize that, notwithstanding their complete absence in certain adult Cetacea, in most Mammals the olfactory bulbs are quite massive; that in Batrachians, Reptiles and most Selachians they constitute a large proportion of the brain; and that in lampreys and hags they equal in size 'the cerebral hemispheres.'

Had the study of the vertebrate brain begun with *Myxine* or *Bdellostoma* the olfactory bulbs would have been unhesitatingly assigned a rank at least equal to that of either of the three following subdivisions.

Whatever the ontogeny in a given case, it is probable that phylogenetically the smelling portion of the brain preceded the reflective.

"The revolution, so to speak, of the 'hemisphere' about the olfactory axis accords with other considerations which have led Spitzka and the writer independently to consider the prevailing idea that the olfactory lobes are mere appendages of the cerebrum as nearly the reverse of the truth."*

2. The Diencephalic Flexure. With Reptiles, Birds and Mammals, the forms with which most anatomists are more familiar, the first (cephalic or 'anterior') of the series of cavities seems to be the '*ventriculus tertius*'; indeed, in some Birds and Mammals the recess at the root of the optic nerve actually lies farthest cephalad. This condition seems to be associated with the gen-

eral crowding of the cerebrum dorsad and caudad over the other parts of the brain. It is discussed briefly in the *American Association Proceedings*, 1887, pp. 250-251; *American Naturalist*, October, 1, 1887, 914-917; Reference Handbook of the Medical Sciences, VIII., 112, and *Journal of Comparative Neurology*, VI., 128.

The following propositions seem to me warranted by the conditions in Batrachians and 'fishes':

However numerous or sharp the dorso-ventral flexures of a given brain, for comparison with other brains or with an ideal schema the axis is to be regarded as straight.

Whatever its actual position, the aural or mesal space between the two portas ('foramina of Monro') constitutes the cephalic member of a longitudinal series of cavities.

From the standpoint of comparative neurology the terma ('*lamina terminalis*') is a constituent of the floor of the encephalic cavities; its dorso-ventral position in Reptiles, Birds and Mammals no more converts it into a morphologic end-wall of those cavities than its dorso-caudal inclination in certain forms entitles it to be interpreted as a portion of the roof.

3. In order to be entitled to rank as a definitive segment must a given region exhibit the dorsal and ventral zones of His?

Conceding, for the present, the constancy and significance of these zones in the myel (spinal cord) and in the brain as far as the cephalic orifice of the mesocoele ('aqueduct'), are they represented in the region beyond?

In the absence of complete developmental and histologic evidence on that point, my provisional answer in the negative is based upon two very different considerations:

First, the general distinctions between the parts derived from the first encephalic vesicle and the rest of the cerebro-spinal axis. *Secondly*, the unsatisfactory presentation of

* The Dipnoan Brain, *American Naturalist*, June, 1887, p. 546.

the subject by those who attach most importance to it.

In 1859 and 1861 Reichert described and figured (*Der Bau des menschlichen Gehirns*, Plates II., X., XI., p. 65, line 5) a furrow on the mesal aspect of the thalamus, connecting the 'aqueduct' with the *foramen Monroi*. To this he applied the name *sulcus Monroi*, which has been generally employed. In 1884 the mononym *aulix* was proposed by me, and the feature has been shown distinctly in the *New York Medical Journal*, March 21, 1885, p. 327, and 'Reference Handbook,' Vol. VIII., p. 122, and IX., Fig. 418.

In his exposition of the schema adopted by the Anatomische Gesellschaft (B. N. A., pp. 157-159) Professor His insists upon the great morphologic significance of the dorsal and ventral zones, and of the '*sulcus limitans ventriculorum*':* by which they are demarcated. He further declares that the continuation of this sulcus is the *sulcus Monroi*. But his figures represent the sulcus as terminating, not, as with Reichert, at the *foramen Monroi*, but at or near the optic recess, and, without explanation of the radical deflexion, he says, "Die Sulci Monroi laufen jederseits im *Recessus opticus* aus." The confusion caused by this unspecified transfer of a title to a different feature is augmented by the account of the same matter by C. S. Minot in the *Popular Science Monthly*, July, 1893; here the text is explicit as to the importance of the sulcus and its termination at the *foramen Monroi*; but the figure represents the boundary between the zones at a point farther caudad.

In this connection it should be stated that the recent studies of Mrs. S. H. Gage upon embryo cat, turtle, batrachian and bird (*Amer. Nat.*, October, 1896, 837) have revealed sulci having various directions, but not, apparently, demarcating the dorsal and ventral zones.

*For this I have proposed the more definitely correlated name *sulcus interzonalis*.

In view of the present aspect of the case, while I see no impossibility in the representation of the dorsal and ventral zones in the first three segments of the brain, and while such zones might well be demarcated by the furrow originally described by Reichert as '*sulcus Monroi*' (my *aulix*), I hold that the interpretation of the olfactory portion of the brain as merely one part of the dorsal zone of a segment must be supported by something more than the designation of a limiting sulcus which is apparently either non-existent or without interzonal significance.

Psychology. PROFESSOR J. McKEEN CATTELL, Columbia University.

THE speaker said that the knowledge of paleontology, reasonably presupposed by Professor Osborn on the part of all students of natural science, could scarcely be expected in the case of psychology. Neither was it possible to exhibit the whole of psychology on a single blackboard, as Professor Osborn had done for paleontology, or even in a more bewildering series of charts, such as Professor Wilder had found needful for neurology. He could only make some very general, and, he feared, somewhat trivial remarks.

Each science has problems in common with other sciences and problems peculiarly its own. We who are trying, each of us, to advance some little department of science cannot but sometimes stand at gaze before the magnitude of modern science. How can we see the forest for the trees, the library for the books, the world for the facts? Professor Klein has said that mathematics is ten thousand years in advance of the other sciences, but how does he know whether the sciences are an asymptote to his mathematics or whether mathematics are going off on a tangent to the rest of the universe? Professor Klein tells us that to the regular polygon of 65,537