III. "Contributions to the Anatomy of the Central Nervous System in Vertebrate Animals. Part I. Ichthyopsida. Section 1. Pisces. Subsection 1. Teleostei." By ALFRED SANDERS, M.R.C.S. Communicated by Professor HUXLEY, Sec. R.S. Received May 7, 1878.

(Abstract.)

The brain of *Mugil cephalus* consists of three pairs and one unpaired tuberosity above, and two below.

The most anterior pair are the olfactory lobes. From the anterior to posterior end they present four layers; first, olfactory nerve fibres with cell-like swellings upon them; second, coarsely granular neuroglia, with incipient glomeruli olfactorii, and large tripolar nerve cells; third, small usually unipolar cells each in its own space in the neuroglia; the whole collected into a rounded mass; fourth, nerve fibres proceeding from this mass to the second pair of tuberosities, the cerebral lobes, which consist of finely granular neuroglia, in which small cells are situated towards the circumference, and larger cells towards the centre, each of the latter contained in a lymph space.

The third pair of tuberosities, the optic lobes, corresponding with the corpora quadrigemina, are formed of a thin layer of nervous substance, enclosing a ventricle; this layer, the *tectum*, consists of seven strata: first, granular neuroglia; second, oblique fibres with fusiform cells; third, radiating fibres; fourth, oblique fibres; fifth, transverse fibres; sixth, cells of a small size; seventh, connective tissue with an epithelial lining to the ventricle of this lobe. Within this ventricle, on the floor, are two tuberosities, tori semicirculares, faced with connective tissue, and containing small unipolar cells arranged along the margin. Behind, the ventricle in question is closed by a process from the unpaired tuberosity (cerebellum), which occupies the position of the valve of Vieussens; this is the valvula cerebelli; it forms a fold in the ventricle, and joins a longitudinal ridge situated along the contiguous inner margins of the tecta; on the side of the valvula are processes more or less developed in different fishes.

The unpaired tuberosity is the cerebellum; it has a structure comparable to that of the cerebellum of the newly-born human infant.

The tuberosities below are the hypoaria, which receive fibres from the ventral surface of the medulla oblongata behind, and from the cerebral lobes in front. Between the two hypoaria is the pituitary body, and also a saccus vasculosus.

The medulla oblongata behind the cerebellum has two tuberosities, constructed in the same way as the tori semicirculares; they are the vagal tuberosities.

Ventricles :—

The fourth ventricle consists of two parts, one part beneath the cerebellum, the other part, a deep fissure between the vagal tuberosities; they communicate with each other by means of a narrow quadrangular passage.

The ventricle of optic lobe is simply the remains of the ventricle of the corpora quadrigemina in fœtus, and now part of the aqueduct of Sylvius.

The third ventricle, between the cerebral lobes and the optic lobe, communicates behind with the last, and below with pituitary body by means of the infundibulum; above, it is closed in by the stalk of the pineal gland.

Origins of nerves :—

The olfactory nerve arises from the olfactory lobe.

The optic nerve arises by three roots, first from the tectum lobi opici, second from the torus semicircularis, third from the hypoarium.

The motor oculi arises from a ganglion beneath the floor of the aquæductus sylvii; it partially decussates.

The trochlearis arises from anterior part of the base of the cerebellum.

The trifacial arises by three roots from beneath the anterior end of the crura cerebelli; its deep origin is from three distinct points; first, from cells beneath the floor of anterior part of the fourth ventricle; second, from the external lateral part of the spinal cord; third, from the central part of the vagal tuberosity.

The abducens arises from two small ganglia in the ventral horn of grey matter beneath the narrow part of the fourth ventricle.

The acusticus arises from the lateral part of the medulla oblongata in the region of the ganglion of the vagus.

The glossopharyngeal has a separate origin in mugil, in other fishes it is a branch of the acusticus, in others again it is a branch of the vagus; here it arises from the grey matter covering the narrow part of the fourth ventricle.

The vagus arises by two roots, one from a ganglion beneath the floor of posterior end of the fourth ventricle; the other from the cerebellum, and from the grey matter covering the narrow part of the fourth ventricle.

The first spinal nerve, although passing through a foramen in the exoccipal, takes the place of the hypoglossal, rises by dorsal and ventral roots, forms with the second spinal nerve the brachial plexus, and supplies the region of the tongue.

The spinal nerves have a ganglion on the dorsal root.

The commissura ansulata, placed at the exit of the trochleares nerves, is partly a longitudinal and partly a transverse commissure; it first appears on the external and lateral part of the medulla, opposite the

posterior part of the fourth ventricle, passes forward, and at the point above-named ascends on the external edge of the medulla, and forms the commissure of the tecta lobi optici, at the base of their longitudinal ridges above described; this commissure also forms a decussation of fibres beneath the ganglion of the trochlearis.

The anterior commissure of the brain is situated between the cerebral lobes.

The posterior commissure is situated on the anterior part of the floor of the ventricle of the optic lobe behind the third ventricle.

A deeper commissure connects the region on each side of the third ventricle passing through the hypoaria in front of the infundibulum.

Two transverse commissures exist in the spinal cord, one ventral, one dorsal.

The ventral longitudinal columns of the cord contain two fibres of gigantic size, one on each side; these decussate opposite the origin of the trifacial on the floor of anterior part of the fourth ventricle; the longitudinal columns pass to the internal part of the floor of ventricle of the optic lobe, about the posterior end of the fourth ventricle.

The lateral columns of the cord pass forward, and are lost outside the last.

IV. "On the Equations of Circles." (Second Memoir.) By JOHN CASEY, LL.D., F.R.S., M.R.I.A., Professor of Mathematics in the Catholic University of Ireland. Received May 10, 1878.

(Abstract.)

In the year 1866 was published in the "Proceedings of the Royal Irish Academy" a paper "On the Equations of Circles," which contained extension of many known theorems. Thus it was proved in it that the same forms of equation which are true for a circle inscribed in a plane or spherical triangle hold also when the right lines in the one case, or the great circles in the other, are replaced by any three circles in the plane or sphere, and it was shown that the transformed equations represented the pairs of circles which touch the three given circles. The results for circles on the sphere were still further extended, namely, to conics having double contact with a given conic. The paper contained, in addition to these fundamental investigations, many collateral ones on allied subjects.

The memoir, of which I now give an abstract, extends the results of the foregoing paper to a polygon of any number of sides inscribed or circumscribed to a given circle. It is proved for the case of circumscribed figures, that the sides of the polygon may be replaced both on the plane and sphere, by circles touching the given circle; and