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CONTRIBUTIONS TO ENCEPHALIC ANATOMY.

BY E. C. SPITZKA, M.D.

Having, through a piece of good fortune, come into the possession of a living iguana, and thence obtained the brain and cord in a perfectly fresh condition, I was enabled to make a study for the first time of the remarkable brain of this saurian.

As regards the exterior of the encephalon, it presents nothing very different from that of any other higher reptile. On a lateral view, however, it exhibits a much acuter basilar incurvation, approximating to the bird's brain in this respect. As in birds, also, the optic nerves leave the skull directly on emerging from the chiasm. It is remarked also that the optic lobes are far larger than in any reptile or bird thus far examined by anatomists; in fact, excluding the case of the finny tribes, it may be said that the iguana possesses the largest optic lobes in the animal kingdom. They are as massive in their grey and white tissues, and nearly as voluminous as the cerebral hemispheres.

The olfactory lobes and bulbs offer nothing special for consideration.

On a transverse section through the cerebral hemispheres, I am able to identify the component parts of the cornu ammonis of the mammalia. It appears that the medial thin wall of the cerebral vesicle corresponds, with its layer of closely packed pyramidal nerve cells, to the *stratum corporum nervorum arctorum* of Kuppfer, and it is indeed separated from the cortical layer of the convexity, which I believe to correspond, as far as the thin part extends, to the *sigma* of the cornu. At the lower end of the thin-walled vesicle, where a transition of nerve fibres from the *stratum corporum nervorum arctorum* (?) takes place, to the thalamus, and which therefore corresponds to the fornix, there is an accumulation of molecular nerve substance, projecting outwards into the ventricular cavity. This may represent one of the thalamic tubercles; I regard it as much more probable, however, that it corresponds to the body of the so-called fascia dentata.

Now, in sections exhibiting the above features, I find also another which is highly important, in so far as it tends to overthrow another one of the *dicta* on whose strength the sauropsidean and mammalian brains are distinguished. Immediately underneath the median longitudinal fissure, but *over* the third ventricle, there passes a fasciculus of white fibres, uniting the two hemispheres, and particularly that portion of each which corresponds to the cornu ammonis. This is unquestionably the corpus callosum, whose first appearance in the embryo and the lower mammalia we know to be intimately associated with the development of the cornu ammonis.

But it is when we reach the mesencephalon and the region posterior to it, that we discover the most remarkable features of this brain.

As in some other saurians, the cerebellum instead of being curved backward, and constituting a cap over a part of the lateral ventricle, as in the alligator and chelonia, is bent forward, and bound to the posterior face of the optic lobes by the arachnoid filaments. On separating and drawing it backward, thus making it correspond artificially in position with the cerebellum of the alligator, we find that between the optic lobes and the cerebellum there are two pairs of tubercles.

One of these pairs, which I have found as a concealed mass in turtles, and as a very distinct elevation in the alligator, ophidia and pseudopus, I was familiar with, and I had no hesitation in describing it as the post-optic ganglia corresponding to the posterior pair of the corpora quadrigemina. The other was at first new to me, but after a careful comparative study I found that it was nothing but an unusually large, and therefore more prominent representative of a ganglionic mass which I have noticed in fair development in the turtle, and which is even represented in an atrophic condition with the mammalia. As the pair of tubercles in the iguana lies intermediate to the optic and post-optic lobes, I propose for it the name of inter-optic lobes.

On a dorsal view these different parts lie about as follows: In front are the massive optic lobes touching each other broadly on the middle line, so that their posterior margins form a continuous semi-lunar curve, convex behind. Behind each optic lobe, and bulging out somewhat, laterally, we have the smaller but distinct post-optic lobes, which fail to come in contact in the median line, so that a shallow groove would separate them, if it were not filled out by another structure now to be described.

If we imagine the median furrow separating the optic lobes prolonged between the post-optic lobes, and crowd two little pea-shaped eminences on each side of this imaginary median line, so that the latter are bounded in front by the optic lobes, on the outside by the post-optic lobes, and behind by the cerebellum, we will have the precise situation of the inter-optic lobes. These eminences are not so remarkable for their absolute size (their surface extent being only half that of the optic lobes) as for the distinctness of their demarcation. I have obtained sections through their posterior third, in which these bodies are shown to be absolutely free.

Other sections further forward show that these ganglia crop out of a specialized division of the central tubular grey of the aqueduct, and that the visible eminences do not represent the true extent of the ganglia.

The trochlearis nerves arise behind the inter-optic lobes, and passing forwards and downwards, lie in the furrow between the optic and post-optic lobes, as in other reptiles. It is well known that in the mammalia they pass down behind the post-optic lobes. I look on this as an incidental and insignificant variation.

The remainder of the isthmus shows nothing especially noteworthy. The remarkable size of the oculo-motor nuclei, and the gigantic dimensions of their almost star-like multipolar nerve-cells, merits mention, as well as the fact that in this animal the nuclei of the third and fourth pairs constitute a common cell mass, unlike the relation in the mammalia, and that the third and fourth pairs arise almost in the

same plane, the third from the ventral, the fourth from the dorsal extensions of the common nucleus.

I would call attention to the fact that the average dimensions of the cell nuclei of the auditory nerve nucleus equal those of the motor nuclei of the medulla and cord, and exceed some of them, and that the same statement applies to the cells as a whole. I make this statement in view of the recent communication of Dr. Mason before the American Neurological Association, though I do not claim to make it on the same basis of careful and extensive micrometric observations that his communication was based on, but on a general impression derived from repeated examinations which I think are sufficient to determine palpable differences.

The present preliminary report is taken from a communication made by me to the *Journal of Nervous Diseases* for last June, but I trust before long to submit to your readers a more exhaustive and illustrated record of this interesting and suggestive piece of cerebral anatomy.

DRY "MOUNTS" FOR THE MICROSCOPE.

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II.

In a former paper, SCIENCE No. 3, I made a few remarks upon this subject, and described the methods which I had found tolerably successful, viz.: the rings made of shellac and lampblack, and those punched out of gutta-percha tissue. The former appear to answer quite well, and the changes, if any, are very slight, yet I have, in a very few cases, observed a deterioration after the lapse of a year or so, probably from imperfect manipulation. Although I have not myself observed any great change in the gutta-percha mounts, I am not certain that they will stand prolonged use with immersion objectives without injury. I have mounted many specimens of delicate test objects for the Messrs. Spencer, and they are decidedly of the opinion that the shellac ring is the better for durability, and I am informed by Mr. Gundlach that the gutta-percha ring will not stand cedar oil. Mr. Phin has suggested that in time the gutta percha tissue will disintegrate. I have not yet noticed this, and do not think it will happen under the cover of a "mount" especially if protected by a ring of cement subsequently applied. If, however, such disintegration does, in time, happen to the tissue, this will be a great objection to its use. I have found that the "tissue" becomes so charged with electricity by handling, and also by the punching, that it interferes seriously with the latter operation, and thus makes it necessary to place strips of the "tissue" on thin moistened strips of paper, and to punch out both at the same time. The preparation of the shellac rings by the turn table obliges one to keep on hand a large stock all the time to insure perfect drying, and to have them always ready. I am obliged to have some 1000 or 1500 on hand in advance, and this necessitates a considerable outlay in stock, which will not always be convenient for amateurs. For the above reasons I now propose a new process which appears to meet all the desired wants, and which combines the advantages of the shellac cement and the gutta-percha rings.

The very simplicity of this process causes me to wonder why it was not thought of before. I take a sheet of thin writing paper, white or colored, and dip it into thick shellac varnish (shellac dissolved in alcohol), and hang it up to dry. When thoroughly dry it should have a good glaze of the varnish on it (different thickness of paper can be used according to depth of cell required). Out of this shellac paper I cut my rings, and these can be made in any quantity, and kept for any time. The process of mounting is simple. The slide is cleaned, and the flat paper ring placed in the centre; on this the cover is placed, having the object dried on it, and the two are held together by the forceps and gently warmed; this serves to attach the ring to the slide, and cover, at several points, so that the forceps may now be laid aside. The next step is to take a glass slip, (another slide), and laying this on the cover, to grasp the two slides at each end by the finger and thumb of the two hands, and pressing them tightly together, to warm the slide gently; by looking at the ring obliquely, on the under side, one can tell at once, when all the air is pressed out, and the adhesion is complete between the cover and the ring, and also the ring and the slide, and they must be held together a moment or two to cool. If the lac is sufficiently thick on the paper the adhesion takes place quickly, and with moderate heat, and there will be no danger of breaking the cover, unless it has been warped in the process of warming, which will sometimes occur when very thin glass has been heated too much for the purpose of burning off the organic matter, or when the support is too small in diameter, or when it is not flat. I think I may be able to induce the leading opticians to manufacture this paper and also the rings for sale; for special purposes the paper might be printed beforehand, so that, when mounted, the ring would show on the under side the name of the preparer, or of the object. I cannot conceive of anything more satisfactory than these rings. Many large objects which would be crushed if one used only the shellac rings made on the slide, by the use of the turn table, by the giving way of these by softening, and under the necessary pressure for attaching the cover, are perfectly protected by the paper rings. I am satisfied that the balsam mounts will be much less frequently used, as soon as we can find some *sure* dry process. The diatoms, as a rule, show much better when mounted dry, and with whole frustules, exhibiting both the side and the front view, also the mode of attachment, etc. The dry mounts are certainly to be preferred when they are desired for anything except pretty objects, and even for this latter purpose there is often a very great difference in favor of the dry mount. Although I have not used these shellac paper rings for any very great length of time, yet I can see no reason why they should not be equal to the simple shellac ring for durability, and very much superior to it in other respects.