LITERATURE ON THE FINDS OF TRICHECHUS HUXLEYI.

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Anatomy. — *"On the existence of cartilaginous vertebrae in the development of the skull of birds"*. By Prof. J. W. VAN WIJHE.

(Communicated in the meeting of April 26, 1907).

It is a well-known fact that at a certain stage of development the notochord in all vertebrates extends forward as far as the hypophysis cerebri and backwards as far as the tip of the tail.

Over the whole length of the trunk and also in the occipital region of the head the dorsal part of the mesoderm is separated into segments or somites.

In the lower vertebrates: Selachians and Petromyzontes, the somites are not restricted to the occipital region, but extend forward as far as the hypophysis, i.e. equally far as the notochord.

The greater part of the voluntary muscular system is formed from the somites and in Amphioxus the segmentation of this muscular system is permanent and distinct from the anterior to the posterior end of the body.

The original function of the somitic muscles of the Chordates existed in my opinion [1]) in the to and fro movement of the notochord and so of the whole body during swimming.

In the Craniotes this muscular system is interrupted in the region of the auricular organ and in my opinion the presence of the auricular capsule is the cause of this. This capsule, which also encloses the organ for equilibrium, needed a firmer attachment than could be afforded by the connective tissue and found it in the parachordal cartilage, through the stiffness of which the muscular fibres in this region could no longer operate and consequently disappeared, partly even in their origin.

[1]) Cf. VAN WIJHE "Ueber die Homologisirung des Mundes und die primitive Leibesgliederung der Wirbelthiere." PETRUS CAMPER, Vol. IV. 1906.

The effect of this was also felt in the region in front of the auricular organ, but here part of the somitic muscles remained on account of a change of function. They became attached to the here developing eye-ball and now served for the movement of this latter and no longer for the movement of the whole body. This was accompanied by far-reaching shiftings, which can still be followed in the individual development.

The cartilaginous skeleton forms a system which appears only late in the development of the vertebrates and long after the appearance of the muscular system. As soon as the first cartilage may be observed, the muscular system in the head has undergone the changes here indicated. In the auricular region the somitic muscles have degenerated; partly they were not even indicated; in the region in front of the auricular organ they have entirely changed in place and shape and have entered into the service of the eye-ball. Only in the region behind the auricular organ — the occipital region — the myotomes — generally numbering three — still stand in the original order, like the myotomes of the trunk.

Head and trunk are separated in the ontogeny — although the border is later somewhat shifted in a caudal direction — already before the cartilaginous spinal chord appears, and I see no reason for assuming that this separation should not have taken place also in phylogeny before the appearance of the spinal chord.

The segmentation of the spinal chord depends on that of the muscular system. The body of a vertebra is not formed opposite the middle of a myotome, but opposite the border of two successive myotomes. BALFOUR has given the explanation of this at first sight curious phenomenon: the first muscular fibres occupy the whole length of a myotome and lie laterally of the tissue, surrounding the notochord. Now it is no more than natural that the solid points of attachment which in this tissue are formed for the muscular fibres, namely the origin of the vertebral bodies, are formed opposite the borders of two successive myotomes.

If we now ask where the appearance of vertebral bodies in the head must be expected, the answer must be that this cannot be in the auricular region, since here the myotomes have disappeared at the time of the appearance of the cartilage. No more can this be the case in the region in front of the auricular organ, for here the myotomes have entirely altered their place and have entered into the service of the eye-ball.

Only in the occipital region one would expect the appearance of two or three vertebrae. Yet until recently nobody has observed them

here, although this region has been investigated not only by the method of sectional series, but also by the methylene blue method, by which the investigation is so much easier. By this method Dr. NOORDENBOS did not find them in the vertebrate skull any more than myself in the skull of Selachians.

Instead of vertebrae we found the well-known parachordal cartilage accompanying the notochord in the occipital and auricular regions.

Certain authors have indeed spoken of the origin of vertebrae in the occiput, but the parts observed by them, were not cartilaginous but only badly outlined cell-heaps, not deserving the name of vertebrae.

So I was greatly surprised when my former assistant, Mr. F. SONIES, discovered by the methylene blue method two cartilaginous vertebral bodies in the occiput of embryos of the chick of the sixth breeding day and of ducks in a corresponding stage.

It will be asked how it is possible that these vertebrae have not been long known, since the embryos of the chick form the classical material for investigation in all embryological laboratories. The answer is that they were not discovered because the stage, in which they appear, is of so very short duration. One has to hit the moment in which the cartilage appears in the first two vertebrae of the neck. Before the cartilage appears in the remaining vertebrae, the two occipital vertebrae have already coalesced with the parachordal cartilage.

It is impossible to indicate the hour of the breeding day, since the development of the different eggs varies too much. By taking a large quantity of material, however, it is always possible to obtain the desired stage. It would require an immense expenditure of time to work all this material by the sectional method. With the methylene blue method, however, one is ready in a few days.

So the parachordal cartilage of birds does not originally form a morphological unity. With SONIES we may distinguish two parts in it: an anterior praevertebral part, situated in a region where the myotomes are degenerate or abortive and a posterior or vertebral part, occurring in the shape of two vertebral bodies, which soon coalesce with the anterior part.

Corresponding to these two vertebral bodies later also two vertebral arches appear on each side, which soon coalesce, but the locality of which remains indicated by two openings for the two roots of the nervus hypoglossus.

For further particulars and for several new discoveries about the development of the cartilaginous skull and the spinal column of

birds, I refer to the academical thesis of Mr. SONIES, which is now going through the press and will soon be published, also in "Petrus Camper". I will only mention that the small polar cartilage, discovered by NOORDENBOS in mammals and which also appears in Selachians, was found by SONIES also in birds.

Microbiology. — *"On Lactic acid fermentation in milk"*. By Professor Dr. M. W. BEIJERINCK.

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In milk left to itself, which in consequence of spontaneous infection, contains the more generally distributed germs, with certain regularity some special floras are observed, whose composition is chiefly controlled by two factors: temperature and oxygen pressure. If the latter is very slight, that is, if the microbes of the milk are reduced to more or less anaërobic conditions, the floras become simple of composition and produce certain fermentations. The three principal of these are the Aërobacter-, the Butyric acid- and the Lactic acid fermentations, of which the two first are always characterised by the evolution of hydrogen and carbonic acid, whilst in the lactic acid fermentations, which may occur under different forms, beside the lactic acid, no gas at all, or carbonic acid only is formed. Sometimes this fermentation is accompanied by a vigorous slime formation, which slime consists of the swollen cell walls of the inferred lactic acid ferments.

For domestic purposes the lactic acid fermentation should be considered as useful; both the others as noxious.

The fermentation experiment the dairy industry applies to judge of the purity of milk has for its object to determine the commonness or the rarity of the germs of Aërobacter and of the butyric acid ferment. To this end a high standing glass is filled with milk, placed in a water bath of 40° C. and it is observed whether any fermentation gas is evolved, and if so, after how much time. In good milk this production of gas does not occur because then the lactic acid ferments develop so quickly that the other microbes are expelled. Artificially the Aërobacter fermentation is easily obtained by infecting non-acidified milk with faeces, soil or canal water and cultivating at about 37° to 40° C. After 6 to 12 hours production of gas is observed originating from *Aërobacter coli* or more rarely from *A. aërogenes*. The nature of the thereby obtained varieties changes with the temperature.

At temperatures beneath 40° the Aërobacter fermentation, after