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OBSERVATIONS ON THE CRANIAL NERVES OF CERTAIN GANOIDS

H. W. NORRIS

The forms considered are *Amia* and *Lepidosteus* (Holostei), and *Polyodon* and *Scaphirhynchus* (Chondrostei). The cranial nerves of these forms bear very obvious relations to the degree of development of certain external sense organs. That *Amia* and *Lepidosteus* are teleost-like in their nerve relations accords with the common view of their relationships in general; *Polyodon* and *Scaphirhynchus* on the other hand show in their cranial nerves elasmobranch relations.

An outstanding feature of the nervous system of *Amia* is the presence in the skin of the head of an enormous number of "terminal buds." These necessitate a correspondingly exaggerated nerve supply. The visceral sensory elements supplying these externally situated sense organs come from the facial, glossopharyngeal and vagus nerves. To reach their destination in the skin these nerve fibers for the most part appropriate nerve trunks and branches already existing rather than develop new pathways. The ramus palatinus VII of *Amia* probably carries more of these taste-bud fibers to the skin than all the other cranial nerves combined. But we know that the ramus palatinus is a visceral sensory nerve and ordinarily has no relations with the skin. In *Amia* the ramus palatinus reaches its cutaneous distribution through the mandibular and maxillary rami of the trigeminal nerve and the buccal, superficial ophthalmic and otic rami of the facial nerve. The supratemporal branches of the glossopharyngeal and vagus nerves, usually lateral line exclusively, also carry taste-bud fibers. These latter branches anastomosing with the ramus oticus produce that which Allis calls a "closed circuit." This condition in *Amia* can hardly be considered as primitive or typical, and the assumption that the trigeminal nerve fundamentally contains visceral sensory fibers is unwarranted.

In *Lepidosteus* there are fewer cutaneous taste-buds, consequently the ramus palatinus VII and other visceral sensory branches of the cranial nerves sending fibers to the skin are smaller. But the relations are fundamentally the same as in

Amia. The arrangement and innervation of the lateral line sense organs (canal organs and pit organs) in *Amia* and *Lepidosteus* are almost identical, allowing for the much elongated body of the latter. The gular series of pit organs in *Amia* is, however, lacking in *Lepidosteus*. The most striking difference between the cranial nerves of the two species is the total lack of a ramus mandibularis internus in the facial nerve of *Lepidosteus*.

In *Polyodon* we see an enormous development of lateral line sense organs, chiefly on the exaggerated rostrum and the elongated gill-cover. The so-called "primitive-pores" of *Polyodon* are certainly sense organs, and supplied by lateral line fibers of the seventh, ninth and tenth nerves, chiefly from the seventh, possibly exclusively so. Whether the primitive pores correspond to pit organs or to the ampullae of Lorenzini of the elasmobranchs the writer does not as yet have any decided opinion. The medulla oblongata of *Polyodon* possesses a large lateral line lobe into which enters the greater part of the lateral line elements of the seventh nerve. This lobe is an elasmobranch character and is lacking in *Amia* and *Lepidosteus*. Another elasmobranch character in *Polyodon* is the sharp distinction between the branches of the trigeminal and facial nerves. There is never any anastomosing between these nerves, such as is seen in *Amia* and *Lepidosteus*. Taste-buds are few and found externally only in the region of the mouth (Allis). The anterior extension of the ramus palatinus facialis is small, almost rudimentary. The rudimentary barbels are supplied by vestigial twigs from the ramus palatinus VII and the ramus maxillaris V, but no sense organs of any kind have been found on the barbels.

It would seem that there should never have been any doubt that the "primitive pores" of *Polyodon* are strictly comparable to the "nerve sacs" of the sturgeons. They are similar structures, parts of the lateral line system. In the true sturgeons, however, the lateral line organs are not so extensively developed as in *Polyodon*, and the nerve sacs are more aggregated than the primitive pores. In *Scaphirhynchus* (and in *Acipenser*, presumably) there is a great development of taste-buds. These, however, are not generally distributed in the skin, as in *Amia* and *Lepidosteus*, but occur in great abundance on the two pairs of barbels and the oral fringes. In consequence the trigeminal and facial nerves are as sharply distinct as in *Polyodon*, only certain peripheral parts of the ramus palatinus VII and the ramus maxillaris V uniting to supply the barbels.

General cutaneous components occur in the tenth and possibly the seventh nerves of *Polyodon* and *Scaphirhynchus*, but not in such relatively large amounts as in *Amia* and *Polyodon*.

On the basis of the origin, composition and distribution of the cranial nerves the *Holostei* are sharply distinct from the *Chondrostei*, supporting in this way the more general conclusions of comparative anatomy.

This paper is intended as a preliminary report, to be followed by a more extended account with ample illustrations, in which the related literature will be discussed, especially the agreements and disagreements with the classic accounts and discussions of the ganoid fishes by Allis.

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