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On the Central Nervous System of *Notorhynchus platycephalus*

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In previous papers (MASAI, 1961, 1963a and 1963b) the present author described the external form of the brain and the cross section of the spinal cord of *Chlamydoselachus anguineus* and *Heptranchias perlo*. *Chlamydoselachus* has six gill slits, resembles *Cladoselache*, an early shark, and should be considered a living fossil. *Heptranchias* is furnished with seven gill slits, and the number of gill slits of these sharks is greater than in majority of the recent sharks. The brain and spinal cord of these archaic sharks are less developed, than in recent sharks. The present material, *Notorhynchus platycephalus*, belongs to the Hexanchidae and has seven gill slits, and therefore, this shark, also is considered to be an archaic species, as is the case with *Chlamydoselachus* and *Heptranchias*. The purpose of this study is to investigate the pattern of the central nervous system of *Notorhynchus platycephalus*, comparing it with that of *Chlamydoselachus* and *Heptranchias*.

Material and Method: The material was furnished by Dr. T. ABE, to whom the author expresses his sincere thanks. *Notorhynchus platycephalus* observed measures about 120 cm. in body length, and was fished in northern Japanese waters. The brain was removed and fixed in 4% formalin solution. An upper portion of the spinal cord was fixed in BOUIN's fluid and cut into frontal serial sections at 20μ, then the sections were stained with carbol-thionin.

Observation: (figs. 1-7) The brain of *Notorhynchus platycephalus* is much flattened and therefore, there is a large space between the brain and the cranium, in contrast to the brain of the recent sharks, which is swollen and voluminous in general. The olfactory bulb has a shallow furrow in the middle of the dorsal surface and is located close to the nasal sac. The olfactory tract of *Notorhynchus* is roundish, while the olfactory tract of *Chlamydoselachus* is depressed. The terminal nerves emerge from the recessus neuroporicus, proceed on the rostral surface of the lateral lobes of the telencephalon and afterwards along the olfactory tract reach the dorsal surface of the olfactory bulb and end at the nasal sac. In the figures 1-6, the terminal nerves are artificially separated from the olfactory tract. The lateral lobes of the telencephalon on both sides are distinctly separated from each other, and thus the recessus neuroporicus becomes much more depenped. The lamina supraneuroporica and the lamina infraneuroporica are flattened, and the lamina supraneuroporica is more reduced than the lamina infraneuroporica. The telencephalon medium is relatively long and has a membranous roof.

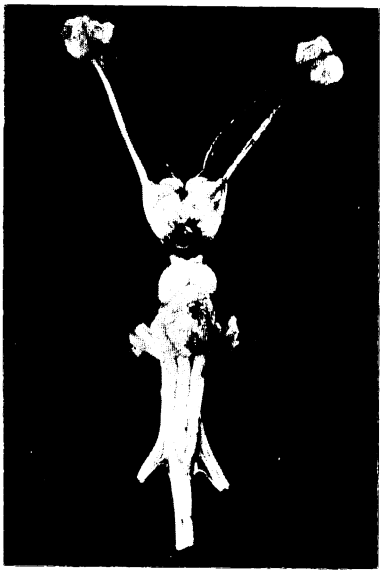

Fig. 1. Dorsal view (×5/9).

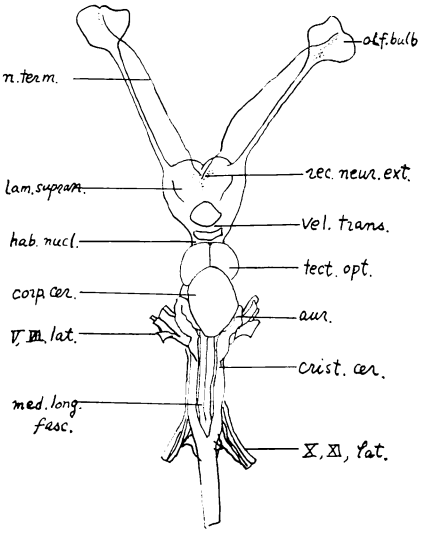

Fig. 2. Dorsal view.

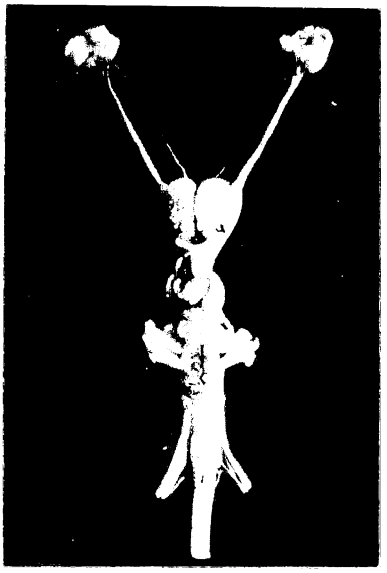

Fig. 3. Ventral view (×5/9).

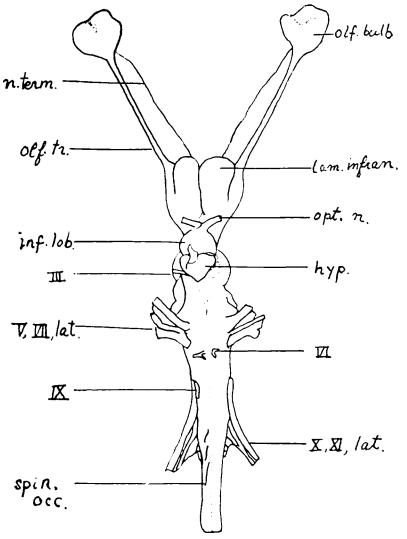

Fig. 4. Ventral view.

As to the diencephalon, the habenular nucleus is visible in the dorsal view, and the hypothalamus, saccus vasculosus and hypophysis occupy most of the diencephalon. The optic nerves cross at 160°. The optic tectum is swollen to the same degree as that of *Chlamydoselachus*, and the caudal half of the tectum is covered by the corpus cerebelli.

The corpus cerebelli is symmetrically rhomboid in shape in the dorsal view and

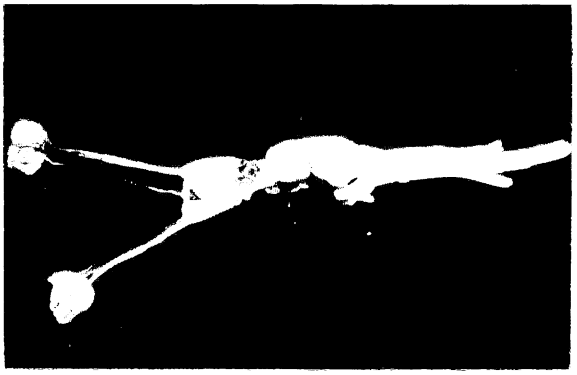

Fig. 5. Lateral view (5/9).

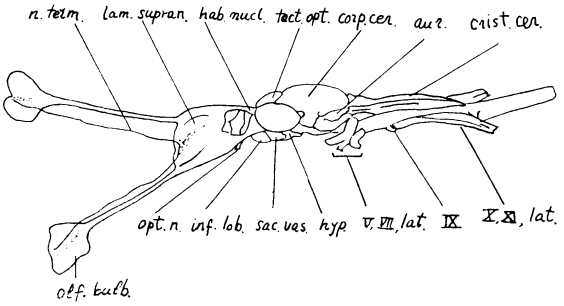

Fig. 6. Lateral view.

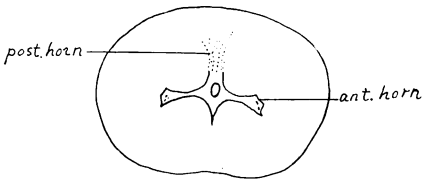

Fig. 7. A cross section of the spinal cord (×6).

shows no furrows, The lips of the auricle are folded slightly, and less developed than that of *Chlamydoselachus*.

The medulla oblongata is flattened and more slender, as is *Heptranchias perlo*. The sulci, which limit each column, appear clearly in the floor of the rhomboid fossa. The lobulation occurs slightly in the afferent visceral column. The accessory nerve leaves the oblongata and the spinal cord with several rootlets, as it does in *Chlamydoselachus* and *Heptranchias*.

The cross section of the spinal cord is oval, and the anterior median fissure is very shallow. The pattern of the gray matter appears as an inverted T in shape. The posterior horns on both sides lie very close together and are jointed with bridges of the gray substance. There is no compact dorsal funiculus. This pattern on the gray

matter is common among the spinal cords of selachians. But the gray matter of *Notorhynchus* is less developed than in recent sharks: in particular, the posterior horn becomes slender, and its dorsal end does not reach the posterior surface of the spinal cord. The substance occupies a wide area out of proportion to the gray substance. Such a pattern of the spinal cord is similar to that of *Chlamydoselachus* and *Heptranchias*.

Summing up, the brain and the spinal cord of *Notorhynchus platycephalus* resemble, as a whole, those of *Chlamydoselachus anguineus* and *Heptranchias perlo* (MASAI, 1961, 1963a and 1963b), *Heptanchus cinereus* and *Hexanchus griseum* (BURCKHARDT, 1911), and thus present the prototype of the pattern of the recent sharks.

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