so-called dorsal root of that nerve receiving its fibers from the root of *nervus lineæ lateralis* and from the *ramulus ampullæ posterioris*.

If the terminal buds, found in such numbers and so irregularly distributed over the head of *Amia*, represent a stage in the development of the canal organs, they and the nerves innervating them should arise in connection with sensory ectodermal thickenings, as do the canal organs and their nerves. Allis has shown that those trigeminal and facial nerves, in *Amia*, that are known to innervate terminal buds or regions where those buds abound, all arise from the median, *fasciculus communis* portion of the main trigemino-facial ganglion. He thinks it probable, as Strong has suggested, that "the *fasiculus communis* tract of the brain is largely or entirely concerned in the innervation of terminal buds."

The *chorda tympani* belongs probably to the *fasciculus communis* nerves, and is represented in *Amia*, by the *mandibularis internus trigemini*.

There is no true *ramus ophthalmicus profundus* in *Amia*, but the ganglion is distinct, and a rudiment of the nerve is sometimes seen.

The "hitherto undescribed cranial nerve" of Pinkus in *Protopterus* is found in *Amia*.

THE GIANT GANGLION CELL APPARATUS.

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The following report, read before the Neurological Seminar of the Marine Biological Laboratory in July, 1898, is an outline of some recent work on the problem presented by the "Giant Ganglion Cells" found in the median dorsal fissure of the myelon of a number of fishes. This report includes several recent advances made by the writer on the problem in question,

The name "Giant Ganglion Cells" is objectionable, as it not only describes nothing but their size, but is used for other large nerve cells in many scattered forms of the invertebrate animals as well as the vertebrates. "Median Cells" or "Dorsal Cells" would seem better, but the writer will refrain from committing himself to a new term until more is discovered concerning the apparatus.

These cells were first described in *Lophius piscatorius* by Fritsch. In this fish they number about 200, are very large and are massed in the anterior portion of the dorsal median fissure. Each one gives rise to a single large neurite, according to Fritsch, which dips down into the cord and becomes a constituent fiber of one or the other of two lateral, symmetrical fiber-bundles. The fibers thus forming part of these bundles pass *cephalad* into the brain and out of that through certain roots of the 10th and 5th nerves. Fritsch considers them to be sensory nerves.

Tagliani found the same large cells in a similar position in the myelon of *Balistis* and of *Orthogoriscus*, in which latter animal he found the fibers running both *cephalad* and *caudad*.

In my article of 1896 (Anat. Anz., Bd. XIII, p. 281) I described these giant cells in a large number of *Heterosomata*, or flounders, and found that the neurites entered the usual fiber-bundles but ran *caudad* in them instead of *cephalad* as Fritsch described for *Lophius*. At the same time I gave certain reasons for believing that this apparent difference in neurite-distribution did not prohibit the homology of the cells in the different forms (p. 291). Other and more satisfactory proof that the giant cells of these fishes are homologous has been found since and consists of the following facts. The giant cell apparatus of *Pseudopleuronectes Am.* was further studied by means of Palladino's Palladium Iodide method (Lee, IVth Ed., p. 413) by means of which it was possible to trace the neurites with more ease and certainty than before. It was then found that in many of the cells the large neurite bifurcated just before entering the fiber-bundle and one branch ran *cephalad*, while the other ran *caudad*, both in the bundle. A Pediculate fish, nearly allied to

Lophius was then examined and the missing caudal fiber was immediately discovered. This fish, *Pterophryne lustris* possesses only 24 giant cells which is the smallest number yet found in an adult teleost fish. These cells are very large and closely resemble those of *Lophius* in every particular. Having demonstrated this bifurcation of the giant cell neurite in these two forms, it is probable that the same will be found to hold true for the other fishes possessing this apparatus.

The number of species in which the giant cell apparatus appears, has been found to be far greater than supposed. A vast number of teleost fishes possess it and the writer does not hesitate to estimate that this number is over one half of the living species. It is found less frequently in the lower orders, the NEMATOGNATHI, for instance, not showing one instance as yet in which it has been found; while the PEDICULATI and HETEROSOMATA fail to yield one species which does not possess it in a highly differentiated and developed form. Where found in a more primitive form it is characterized by the large number, small size, and simple structure of its ganglion cells, while in the specialized forms the ganglion cells are fewer and of monstrous proportions and uncouth structure.

Its relation to the "Transient Ganglion Cells" or "Transient Nerve Apparatus," described in *Salmo*, *Raja*, etc. by Rohon, Beard, Van Gehuchten and others, is clearly, in the writer's mind, one of identity; the giant cell apparatus being composed of some or all of the transient cells which have remained.

Van Gehuchten's discovery of the bifurcation of the neurite of the transient ganglion cells of *Salmo* must therefore be considered the first exposition of this fact for the giant cell apparatus as well.

Many embryonic fishes have been found to possess the transient apparatus and the writer doubts if any form of teleost is without it. Work will be continued on *Pseudopleuronectes Am.* and other forms.