The Giant Nerve Cells and Fibres of Halla parthenopeia.

By J. H. Ashworth, D.Sc., Lecturer in Invertebrate Zoology in the University of Edinburgh.

(Communicated by Professor J. C. Ewart, M.D., F.R.S. Received May 30,—Read June 18, 1908.)

(Abstract.)

An anterior and a posterior series of giant cells are present in *Halla parthenopeia*; the following statement refers to the anterior series.

The primary giant cells are formed in segmental couples—one couple in each of the anterior ganglia of the nerve cord—until a maximum of eight couples is attained. While the last three couples are being formed, secondary giant cells are also formed at the anterior end of the nerve cord and occasionally in one or more ganglia already possessing a primary couple The number of giant cells in full-grown specimens is usually 15 to 18, but specimens with 20 and 21 are recorded.

There is a progressive increase in the size of the primary giant cells until the worm has attained a length of 30 to 40 cm., by which time the giant cells appear to have reached their maximum size. The largest cells are usually those of the second and third couples, which, in adult worms, are 130 to 150 μ in diameter.

Yellow granules are present in the giant (and in some of the larger ganglion) cells, the substance and pigment of which are closely similar to, if not identical with, those of the chlorogogen granules. The granules in the nerve cells therefore appear to be insoluble products of metabolism.

Small, rounded, chromophilous granules are present in the protoplasm (except in a peripheral zone, in which they are almost or quite absent) in varying amount in different giant cells. They are found in greatly increased mass in a specialised peri-nuclear zone, which is distinguishable in the living cell by its greater refringency. The outer edge of this zone is bounded by the peri-nuclear network of neurofibrillæ, which is thus in a position which facilitates its rapid nutrition. In many of the cells there is a "double nucleolus" which consists of one or more acidophile bodies enveloped by a basophile substance.

Each giant fibre, after leaving the giant cell from which it arises, crosses the cord to the opposite side, turns gradually towards the middle line of the cord and runs posteriorly. Some of the largest fibres, from two to six in different specimens, run to within 1 or 2 mm. of the posterior end of the worm, the other fibres taper and successively disappear after running various

distances down the cord. One or more short branches issue from the giant fibre near the angle of decussation, and, as the fibre runs along the dorsal side of the nerve cord, branches issue which fork, the twigs pass to the right and left, they taper, their sheath disappears, and the protoplasmic axis of each twig, now about 1 μ in diameter, is lost to view in the lateral or ventro-lateral region of the neuropile, in no case could it be traced into a spinal nerve.

The sheath of the giant cell and giant fibre is not blackened by the action of osmic acid, it consists of glia fibrils of various thickness, among which glia nuclei and the granular remains of glia protoplasm are present.

The neurofibrillar network in the giant cell is divisible into a peri-nuclear network, situated at the margin of the peri-nuclear zone, and a more extensive, wider meshed, and generally more slender stranded network in the general protoplasm. From this network slender primitive fibrils pass into the cone of origin of the axone, whence stouter fibrils (0·2 to 0·25 μ thick), each due to the fusion of several primitive fibrils, pass into the giant fibre. The number of fibrillæ issuing from the cell varies according to the size of the cell: 6 to 10 issue from the small giant cells, 12 to 30 from the larger ones. The bundle of neurofibrillæ probably does not fill the lumen of the fibre in life (fibrillæ could not be seen in the living or fresh giant fibres), but occupies from one-fourth to three-fourths of the internal diameter of the fibre, the remaining space being filled with the semi-fluid, finely-granular "peri-fibrillar substance." Between the fibrils there is a more homogeneous "inter-fibrillar substance." The fibrillæ in a giant fibre are usually all of the same thickness, but in several fibres there are one to three fibrils thicker than the rest.

The contents of the giant fibre are equivalent, and have a similar structure, to the axis cylinder of a medullated nerve, except that in the former there is nothing comparable to the Ranvier's nodes of the latter.

The anterior giant cells of *Aglaurides fulgida* are also segmentally arranged, there being a couple in each of the first four, five, or six segments. The cells seem to have attained their maximum diameter (90 μ) when the worm has reached a length of 14 cm. In the main features of their structure and of the arrangement of their neurofibrillar network the giant cells of *Aglaurides* agree with those of *Halla*.

Sharply and deeply stained fibrils penetrate the sheath of many of the giant cells of *Halla* and *Aglaurides*, enter the cell and apparently join the intracellular network. Numerous short fibrils, probably of glial nature, enter the peripheral zone of the giant cells of *Halla*.