THE FINE STRUCTURE OF THE CAUDAL NEUROSECRETORY SYSTEM IN RAIA BATIS*

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With 11 Figures in the Text

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Introduction

The caudal neurosecretory system in elasmobranchs differs in its morphology from the corresponding system in teleosts and also from the diencephalic neuro-

secretory system. In several respects it shows a more primitive organisation (BERN and HAGADORN 1959, FRIDBERG 1959, 1962b).

The system occupies a substantial part of the cross-section of the caudal spinal cord along the last 55 vertebrae in Raia batis. There is, however, no storing and releasing center for secretion like the terminal enlargement in telecosts (FRID-
The cells, the Dahlgren cells, are homologous to the caudal neurosecretory cells in teleosts (Speidel 1922, Bern and Hagadorn 1959, Fridberg 1959, 1962b). From the individual cell bodies several processes extend ventrally and terminate at the vascularized ventral meninx sheath (Fig. 1). In this respect and also with regard to their large size (sometimes the cell body has a length of 250 microns) they are unique among the neurosecretory cells.

The caudal neurosecretory cells of teleosts contain secretion granules which, in size and appearance, are similar to the elementary granules of the hypothalamic neurosecretory system (Enami and Imai 1958; Sano and Knoop 1959; Holmgren and Chapman 1960; Bern and Takasugi 1962 and Fridberg 1962a). This is a welcome analogy between the two systems, since the selective methods for the diencephalic system are not successful in revealing the proteinaceous caudal secretion (Enami 1955, 1959; Sano 1958, 1961; Holmgren 1959 and Fridberg 1962a and b).

The abundance of elementary granules and of synaptic vesicles in the examined neurosecretory terminals leads to the concept of the neurosecretory synapse (Wells 1959, Gerschenfeld et al. 1960 and Koelle 1961). This concept, as well as the implications of published reports on impulse conduction (Potter and Loewenstein 1955, Morita et al. 1961, Bennett and Fox 1962 and Ishibashi 1962), strongly indicate the nervous properties of neurosecretory cells and gives an interesting background to the peculiar morphology of the Dahlgren cells in Raia batis.

The Dahlgren cells of elasmobranchs have not been subjected to an electron microscopical analysis as far as we are aware. An examination of the fine structure has therefore been undertaken with the principal object of throwing some light on the following questions.

Is the fine structure indicative of a neurosecretory function? Is the secretion represented in the form of elementary granules and, if so, where are these formed? What is the relation between the terminals of the Dahlgren cells and the vascular lumen? Does the morphology of the terminals give any information on the releasing mechanism? Can the cells be considered to be secretory nerve cells?

Material and Methods

The skates, Raia batis, used in this investigation were caught near the Kristineberg Zoological Station, Fiskebäckskil, Sweden. The animals were killed and the relevant part of the spinal cord was rapidly dissected out and placed in a 2 per cent solution of osmium tetroxide in sea water, it was then further divided into small slices. Fixation time was 2½ hours, fixation temperature 0°C. Dehydration and embedding in Epon 812 was performed according to Luft (1961). Sections were cut with an LKB Ultrotome ultramicrotome and mounted on 400 mesh grids without a supporting film. A Siemens Elmiskop I electron microscope was used, operated at 60 kV, and with a bore diameter of the objective aperture of 50 microns. The improved grid holder constructed by Elbers was employed (1959). The initial magnifications were 2000—15000 times.

All the illustrations in this article are from the same specimen, which had a length of 60 cm from snout to tail tip.

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