Neurosecretion in the fresh water prosobranch, *Pila virens*. I—Neurosecretion in the normal and aestivating snails

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Abstract. Investigations on the pattern of neurosecretion in the normal and aestivating specimens of *Pila virens* were carried out. Although secretory cells were found in all the ganglia examined they were absent in the connectives and commissures. No evidence for the presence of neurohaemal organs was obtained. With the onset of aestivation a decline in secretory activity was observed in all the ganglia. This change was quite pronounced in the pleuropedal and least significant in the visceral ganglion.

Keywords. Neurosecretion; aestivation; prosobranch; dormancy; ganglia.

1. Introduction

In contrast to the other gastropods, relatively scant attention has been focussed on aspects of neurosecretion in prosobranchs (Gabe 1966; Simpson *et al* 1966; Martoja 1972). Accordingly a comparative study of the neurosecretory cells of the normal and aestivating specimens of the fresh water prosobranch, *Pila virens* has been undertaken.

The gastropods were collected from ponds and paddy fields near Kariavattom and reared in the laboratory aquaria. For studying the normal pattern of neurosecretion, the animals were sacrificed immediately after collection from their natural habitat. As it was extremely difficult to obtain naturally aestivating specimens, dormancy was induced by keeping them under dry sand for periods up to 12 months. Variations in secretory activity were investigated in post aestivating specimens after exposing them to water for 24 hr.

For the histological study, cerebral, pleuropedal and visceral ganglia as well as their commissures and connectives were dissected out from these snails and fixed in Hollandes fluid for a period of 16 hr Paraffin sections of 6µ thickness from the processed tissue were stained employing chrome alum haematoxylin phloxin (Pearse 1968) and aldehyde fuchsin (Cameron and Steel 1959) methods. Sections from the normal, aestivating and post aestivating specimens were processed on the same slide in order to avoid variations in the staining conditions affecting the results. The criteria outlined by Bern (1962) were used in defining neurosecretory cells.

2. Observations

In general the neurosecretory cells observed were oval or pyriform with a large nucleus and one or two nuclei at its centre. (figures 1, 4, 7). The length and breadth...
of cells ranged from 14 to 18μ and 8 to 12μ respectively. The axons were always short and barely discernible. In very few cases the cells formed clusters with their axons constituting a common channel. No characteristic differences were observed among neurosecretory cells of different ganglia. However, their distribution pattern varied in different ganglia examined. The cerebral ganglia have the perikarya distributed chiefly along its periphery; in the pleuropedal ganglia they are scattered throughout whereas in the visceral ganglion they are confined mainly to the ventral aspect, in close proximity to the blood sinus below. The secretory cells were not discernible in any of the connectives or commissures examined.

The secretory product appears initially as very fine granules, presenting a homogeneous appearance to the cells concerned. Subsequently these granules tend to coalesce forming droplets whereas the transportation of the secretory material may probably occur. Since the axons are rather short the final destination of the secretory product could not be traced conclusively.

Concomitant to aestivation the number of secretory cells declined significantly in all the ganglia examined. The transformation was most marked in the pleuropedal ganglia (figure 5) and least significant in the visceral ganglion (figure 8). The cerebral ganglia however revealed a moderate activity (figure 2, 3). The pigment granules which are regarded as a characteristic feature of the molluscan neuron (Bern 1962) increased considerably in the pleuropedal ganglia. No variations in the pattern of neurosecretion in correlation to the duration of dormancy could be discerned.

When returned to water, the neurosecretory cells of the aestivating specimens resumed their normal activity within the first 24 hr (figures 3, 6, 9).

3. Discussion

Among prosobranchs, the distribution of neurosecretory cells in different ganglia varies from species to species in a heterogenous manner (Gabe 1953). In the most primitive prosobranchs (archaeogastropoda), they are dispersed in the entire central nervous system, even reaching the initial part of the pedal nerve cords. Nevertheless, in the mesogastropoda and neogastropoda, they have not been recorded in the pedal and buccal ganglia. Heteropoda exhibits an extreme case of concentration with all the secretory cells being grouped along the dorsal aspect of the cerebral ganglia. Although a mesogastropod, Pila virens revealed secretory cells in all the three ganglia which were examined.

Despite the wealth of information available on the neurosecretory pattern of pulmonates (Gabe 1966; Simpson et al 1966; Martoja 1972), relatively little data are available on the categorisation of neurosecretory cells into different types in prosobranchia (Gorf 1961; Andrews 1968). In Pila virens staining affinities were found to be similar in all the cells and hence classification based on this criterion was not possible.

Significant variations were noticed in the neurosecretory cells of Pila virens during the active and aestivating phases. It is well known that during the active periods, the neurosecretory system functions optimally and is concerned with regulation of vital activities such as growth, reproduction, etc. Such a function is well evidenced by the continuous production of secretory material in all these ganglia under normal conditions. However, with the advent of aestivation secretory activity declines in all the ganglia examined. Such a general inactivity could be possibly correlated
Figures 1-9. (See captions in p. 327)
Neurosecretion of Pila virens

with the decline in the general metabolic level of the dormant animal concerned. Once this decline in activity is effected it tends to remain static throughout the span of dormancy as revealed by the absence of changes in the neurosecretory cells of the animals inactive for varying periods. It could also be seen that the resumption of neurosecretory activity coincides more or less with the revival of the animal as is evidenced in the post aestivating specimens.

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References

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Caption for figures 1-9

