

Neurosecretion in reproductive behaviour of leeches

In many animals, sexual reproduction involves a whole range of activities and complex behaviours ranging from courtship to copulation and beyond. These behaviours have a neuronal basis which is integrated in their nervous system. The ganglia of the ventral nerve cord of metamerically segmented animals offer a scope to determine the locations of various neurohormones that are involved in reproductive regimens.

Because of its simple organization, the nervous system of leech is considered a favourable material for the study of the specific role played by each ganglion of the ventral nerve cord. Separation of ganglia along the ventral nerve cord into similar clusters reflects a degree of autonomy in controlling stereotyped behaviour of its own body segment (Knowles 1974).

In the Indian cattle leech, *Hirudinaria granulosa*, the cerebral ganglia and the subpharyngeal ganglionic mass are located in the 5th segment on dorsal and ventral regions, respectively. The ventral nerve cord extends from the 5th segment down to the posterior sucker. The terminal ganglionic mass of the posterior sucker represents seven fused pairs of ganglia. Neurosecretory cells in the leech were first described in the cerebral ganglia by Hagadorn (1958) in *Theromyzon rude*, and by Nambudiri and Vijayakrishnan (1958) in *Hirudinaria*.

In *Hirudinaria granulosa* the female reproductive system is confined to the 11th segment. The ventral ganglia close to the ovisacs was chosen by Mishra (1967) for the study of neurosecretory cells. He observed intense neurosecretory activity during the breeding period. This led him to suggest a role of the substances produced by these cells in reproductive physiology of the animal.

A detailed study was carried out to see waves of neurosecretory activities in the segmental ganglia of *H. granulosa* for the entire period of the reproductive cycle (Mishra and Das 1978). These authors showed that about 20% of the neurons that exhibit neurosecretory activity, based on histochemical attributes. These neurosecretory cells are not uniformly distributed among the ventral ganglia extending from 6th to 22th segments. The neurosecretory activity is increased from 20% in Jan-Feb to 35% in March, and then it rises to 40% in May. This follows a decline in neurosecretory activity, but is maintained to a base level (20%). In a nutshell, neurosecretory (NS) activities in the ventral ganglia are biphasic. The waves of NS activities of cerebral ganglia and those of the ventral nerve cord appeared asynchronized. This implied that the neurosecretory products of the ventral ganglia are concerned with some aspects of reproductive physiology, not shared by the NS cells of the brain (Hagadorn 1958; Mishra and Das 1978).

Salzet *et al.* (1993) have extracted oxytocin-like substance and its fragments from the supraoesophageal ganglion of *Erpobdella octoculata* and observed their antidiuretic effect in *Theromyzon tessulatum*. These authors have characterized the oxytocin-like peptides in the supernumerary neurons of the sex segmental ganglia of leeches, with putative antidiuretic function.

A team of five American neurobiologists (Wagenaar *et al.* 2010) in California (Caltech and UCSD), undertook a study to examine the neuronal basis of reproductive behaviour in leeches. They isolated a peptide hormone, hirudotocin, from the ganglia close to the reproductive organs, and injected it into a medicinal leech (*Hirudo verbana*). This invoked a response and leeches began to show a series of movements which included twining around the other member, suggestive of copulatory behaviour. Hirudotocin belongs to a family of vasopressin and oxytocin hormones, which are known to play a significant role in reproductive physiology in mammals including humans. These findings of Wagenaar *et al.* (2010) are supportive of earlier works of Mishra (1967) in which the neurosecretory cells of the ventral ganglia of *H. granulosa* adjoining the ovisac showed hyperactivity during the breeding season.

Keywords. Leech; neurosecretion; reproductive behaviour

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