Chapter 5

Summary
The present study, "Studies on neuroendocrine organ x-organ sinus gland complex of a freshwater prawn, *Macrobrachium dayanum*" attempted to work out the histochemistry and functional aspects of the neuroendocrine organ, x-organ sinus gland complex of a freshwater prawn, *M. dayanum*. It is a medium sized prawn (5-7 cm) found in rivers and water bodies of Northern India.

1. The specimens of *M. dayanum* (both sexes) were collected twice during the months from March to April from Suraha Lake and Dah Lake of Ballia district.

2. Animals were acclimatized in glass aquaria in the laboratory to recover the stress that occurred during catch and transportation.

3. After fixation, sectioning and staining of eye stalk, the histological observation was done to know the general histology and histochemical composition of x-organ sinus gland complex.

4. The optic ganglion of *M. dayanum* was found to consist of four main parts: Lamina ganglionaris (LG), Medulla externa (ME), Medulla interna (MI) and Medulla terminalis (MT).

5. The sinus gland is located in the dorsolateral portion of the axonal connection between ME and MI and supplied with a distinct nerve tract from MT.

6. Neurosecretory cells (NSCs) were evenly distributed in LG, ME and MI, but formed a cluster on the lateral side, in the region of MT. Laterally as well as transversely oriented patches were found across it.

7. The NSCs of ME, MI and MT were together sending their axons to sinus gland and forming medulla externa ganglion x-organ (MEGX), Medulla
interna ganglion x-organ (MIGX) and Medulla terminalis ganglion x-organ (MTGX).

8. All these parts contained mixed population of ‘C’ and ‘D’ types of NSCs.

9. Another organ, 'Organ of Bellonci' was also found to be located on the lateral side of MT

10. For histochemical observations the sections of eye stalk were stained with Bromophenol Blue (BPB), Periodic Acid Schiff’s (PAS) and Sudan Black B, which are specific stains for protein, carbohydrate and lipid respectively.

11. The NSCs present in the LG region and lateral parts of MEGX and MIGX showed higher and lower affinity for PAS respectively, which indicates higher and lower concentration of carbohydrate in these areas.

12. The NSCs of sinus gland x-organ complex showed comparatively higher concentration of protein than that of carbohydrate and lipid, as they showed higher affinity for BPB. The NSCs of almost all the parts of x-organ exhibited higher affinity for BPB, specially the NSCs of LG, MEGX and MIGX region.

13. The NSCs of x-organ showed only moderate affinity to Sudan Black B and stained light brown to dark grey showing an average presence of lipid.
14. The correlation in the concentration of Protein, Carbohydrate and Lipid in descending order is protein > carbohydrate > lipid.

15. Similarly the biochemical analysis of prawn muscles after eye stalk ablation exhibited that the protein level was higher than that of carbohydrate and lipid. However, all these three components were significantly lower in ablated prawns than those of intact ones.

16. These results showed the mobilization and utilization of body protein, carbohydrate and lipid towards the gonads for their maturation and growth as the ablation induces the process of gonadal maturation.

17. The reproductive cycle of *M. dayamum* was found to consist of three phases—preparatory phase, breeding phase and spent phase.

18. The preparatory phase of *M. dayamum* extended from March to May. The percentage of immature and mature ovaries during this phase was 82.57% and 19.34% respectively. Ovaries contained mostly oogonia with few previtellogenic oocytes.

19. The breeding phase of *M. dayamum* extended from June to September. The average percentage of premature, mature, berried and spent animals in breeding phase was: 10%, 44.85%, 34.15% and 20% respectively. Vitellogenic and some previtellogenic oocytes have been observed in ovaries during this period.
20. The spent phase was found to lie in the month of October. About 60-70% of animals were found to be spent during this phase.

21. The GSI values of *M. dayanum* were found to be highest in the breeding phase while lowest GSI values were recorded in the spent phase and preparatory phase respectively.

22. The eye stalk ablated animals showed a significant increase in the GSI value and oocyte diameter and a considerable change in growth, colour and texture of ovaries as compared to corresponding values of controls.

23. Similarly the male reproductive cycle consists of three main phases - preparatory phase, breeding phase and spent phase.

24. During preparatory phase, the maturing testes were observed in maximum percentage (80%) with larger tubules, occupied by primary and secondary spermatocytes, spermatids and spermatozoa.

25. During breeding phase, which extends from June to September, the thin walled tubules were observed with varying dimensions and packed either with spermatozoa or spermatids and spermatozoa both.

26. In the testes of spent phase, the lumen of tubules was irregular with few spermatids and spermatozoa.
27. The eyestalk ablation was found to be a very strong inducer of moultng during any season of the year.

28. Extirpation of eye stalk removes the hormones located in the eye stalk resulting in increased rate of moultng, growth, reproduction and other metabolic activities.