Multi-author Review

Invertebrate neuropeptides: Their localization, structure and function

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Introduction

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This Multi-author Review contains six papers presented at the symposium entitled "Invertebrate neuropeptides: Their localization, structure and function", which was held during the 3rd International Congress of Comparative Physiology and Biochemistry, Tokyo, August 25–30, 1991. The present introduction is based on the chairman's brief introduction given at the symposium.

It might be said that physiological studies on peptidic hormones in invertebrates originated from studies on hormonal control of growth and development of animals. Particularly in insects, hormones associated with morphological changes and behavior characteristic to animals have been the prime target of investigation [14]. In molluscs, remarkable advances have been made in studies on egg-laying hormone and its related peptides [2]. On the other hand, in molluscs, since the discovery of FMRFamide [11], neuropeptides as neurotransmitters or neuromodulators controlling the movement of such specific muscles as cardiac and buccal muscles have been identified [5], and the action of these neuropeptides has served as a genesis of investigation.

Peptidic hormones may be classified into the following three categories: 1) typical hormones circulating in the organism with the blood stream, 2) local hormones or neurohormones acting on tissues or cells of the target organ, 3) neurotransmitters which act at synapses, and/or neuromodulators regulating synaptic action. However, in invertebrates, it is becoming increasingly difficult to classify peptidic hormones so rigidly. This is because it has become clear that the same substance can play multifarious roles, depending on the site where it is produced and secreted [4].

During the past ten to fifteen years, dramatic strides have been made in studies of peptidic hormones. In recent years several outstanding reviews have been published [9, 10, 12], but it is inevitable that ideas will have to be revised or corrected within a few years. It must be stressed that in the background of these prominent advances there has been a remarkable development of techniques of micro-protein chemistry such as HPLC, automated protein sequencers, peptide synthesis techniques radioimmunoassay, immunohistochemistry and gene analysis techniques.

The Tokyo symposium was concerned with arthropods and molluscs. In both these groups, studies on invertebrates peptidic hormones have made great progress. A number of investigators have embarked on studies involving the analysis of genes encoding peptidic hormones. In this symposium, Nagasawa [7] made a presentation on several neurohormones of the silkworm and also described their chemical characterization and immunohistochemistry. He was followed by O'Shea [8], who elucidated the biosynthetic system of adipokinetic hormones (AKH) in the locust and discussed the unique features of biosynthesis of AKH.

A comparative overview of neuropeptides was the core concept of this symposium. Thus, each speaker not only presented the results of his work on particular peptides, but discussed his findings from a broader comparative point of view. Keller [3], in particular, presented to us a comparative overview of crustacean neuropeptides and also discussed both the intra- and inter-specific molecular evolution of peptides. Muneoka [6] focused his presentation on molluscan neuropeptides from the standpoint of comparative physiology and discussed the aspect of diversity and unity of neuropeptides.

One of the advantages of using invertebrates, and molluscs in particular, is that some molluscs possess identifiable giant neurons and it is possible to examine the localization and function of neuropeptides at the level of individual neurons. Weiss [13] described the function of several neuropeptides which exist in specific neurons and modulate the feeding behavior of *Aplysia*. Last but not least, Geraerts [1] presented the results of his study on Light Green Cells of *Lymnaea* which regulate growth, reproduction and energy metabolism.

All of the six speakers are eminent scientists actively engaged in research in the field of invertebrate neuropeptides which relies on state-of-the-art techniques. We hope

that the Tokyo symposium documented in this Multi-author Review, will serve as a useful guide for collaborative research in the future.

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Abbreviations for invertebrate neuropeptides discussed in the following reviews:

AKH	Adipokinetic hormone
APGWamide	Ala-Pro-Gly-Trp-NH_2
APRPs	AKH precursor-related peptides
BUC	Buccalin
CARP	Catch-relaxing peptide
CCAP	Crustacean cardioactive peptide
CDCH	Caudodorsal cell hormone
CHH	Crustacean hyperglycemic hormone
DF 2	Asp-Arg-Asn-Phe-Leu-Arg-Phe-NH_2
DH	Diapause hormone
DRPH	Distal retinal pigment hormone
EH	Eclosion hormone
ELH	Egg-laying hormone
FaRPs	FMRFamide-related peptides
FFRFamide	Phe-Phe-Arg-Phe-NH_2
FLI	FMRFamide-like immunoreactivity
FLRFamide	Phe-Leu-Arg-Phe-NH_2
FMRFamide	Phe-Met-Arg-Phe-NH_2
HGH	Hyperglycemic hormone
IGF	Insulin-like growth factor
M I, M II	AKH-like peptides
MIH	Molt-inhibiting hormone
MIP	*Mytilus* inhibitory peptide (Muneoka and Kobayashi) Molluscan insulin-related peptide (Geraerts)
MM	Myomodulin
MRCH	Melanization and reddish coloration hormone
NF I	Asn-Arg-Asn-Phe-Leu-Arg-Phe-NH_2
PBAN	Pheromone biosynthesis activating neuropeptide
PDH	Pigment dispersing hormone
PTTH	Prothoracicotropic hormone
RPCH	Red pigment concentrating hormone
SCP	Small cardioactive peptide
VIH	Vitellogenesis-inhibiting hormone

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