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Molecular physiology of crustacean and insect neuropeptides

Joffre Mercier[1)], Daniel Doucet[2)] and Arthur Retnakaran

1) Brock University
2) Great Lakes Forestry Center

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Abstract:
Organisms have to constantly respond to environmental conditions to maintain a status of dynamic homeostasis for survival. As single celled organisms evolved into multicellular animals, intercellular and inter-organ communications became indispensable not only to orchestrate homeostasis but also to control the many events punctuating metazoan development. To accomplish this need, a signal transduction system was evolved, consisting of an arborized network of nerves as well as a collection of oligopeptide neurotransmitters (neuropeptides) along with their cognate receptors. We review here the current state of our understanding of the physiology of neuropeptides in the most species-rich group of animals, the crustaceans and insects. The vast majority of neuropeptides signal through cell-surface guanosine-protein coupled receptors (GPCRs). These neuropeptide-receptor systems control a variety of physiological functions, for instance the numerous involuntary movements of internal ducts that are precisely timed for transporting reproductive, digestive and secretory materials. The rigid exoskeleton in Crustaceans and Insects require periodic molts to accomplish growth and metamorphosis and this is harmoniously regulated by a cascade of neuropeptides. Neuropeptides also regulate various events in the life of organisms including biological clocks and behavior. Technological advances in peptidomics, through the routine use MALDI-TOF mass spectrometry and in genomics, with *in silico* identification of neuropeptide receptor genes have revealed a staggering diversity of extracellular peptide-based signaling systems. This diversity underscores that communication between the afferent (nervous) system and the appropriate organs for an efferent response must be done in an unambiguous manner without any short circuits or reversal of directions. While we have a broad understanding of how neuropeptides and their receptors play a vital role in signal transduction, much of the details remain to be unraveled.

Keywords:
crustacean neuropeptides, insect neuropeptides, guanosine-protein coupled receptors (GPCRs)

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