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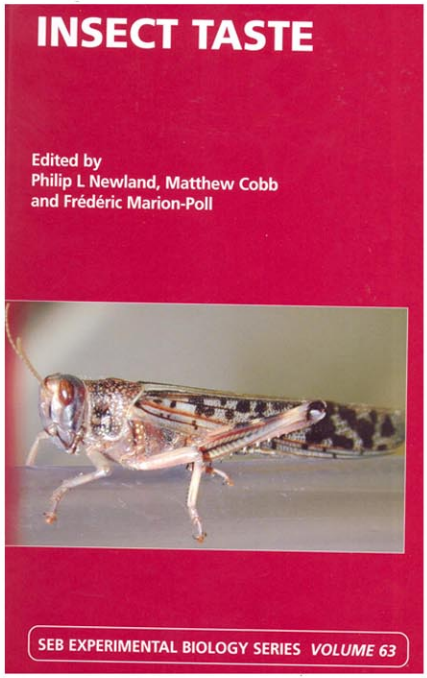

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Effects of experience on the physiology of taste discrimination in insects

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1 Introduction

A fundamental question in neuroethology is how behaviour is modified to allow an animal to adapt to different environments, while simultaneously optimising its development, survival and reproduction. Among animals, insects are the most diverse taxon (Gullan and Cranston, 2000). They comprise over 70% of the known species of terrestrial animals. A large portion of their success is believed to be based on their impressive capacity to adapt to novel environments. Some of these adaptations are the result of behavioural traits that are innate and expressed at the right time. These traits are heritable and expressed in response to specific environmental cues. For example, pheromones have been recognised as inducers or repressors of gene expression associated with stereotyped sequences of adaptive behaviours in insects as well as in other animals (Dulac and Torello, 2003). However, some behavioural traits are plastic and their expression depends on experience.

It is well established that experience alters connectivity in the central nervous system, producing long-lasting changes in behaviour. However, experience can also modify the way sensory systems transduce information from the surrounding environment, and this too can have long-lasting behavioural effects. The molecular and cellular bases of experience-induced modifications in sensory systems and their effects on the central nervous system to shape behaviour are poorly understood. Currently, the readily available genome databases of several animals offer the excellent opportunity to understand the cellular and molecular mechanisms of sensory plasticity in the neural circuitry controlling their behaviours. Insects, with their relatively simple neural circuitry are excellent model systems for understanding in detail the mechanisms of sensory plasticity. Among the sensory modalities, taste plays a critical role in the lives of insects. A diversity of behaviours such as feeding choices, oviposition sites and mate selection, all critical for fitness, utilise taste information. In this chapter, we will focus on the experience-induced modifications of the peripheral nervous system that control taste discrimination in insects. Other model organisms will be discussed in less detail in the context of common mechanisms of taste transduction and coding.