Zoosymposia 2: 339–367 (2009)
www.mapress.com/zoosymposia/

ISSN 1178-9905 (print edition)
ZOOSYMPOSIA
ISSN 1178-9913 (online edition)

Ecology and biology of chemoreception in polychaetes

SARA M. LINDSAY
School of Marine Sciences, University of Maine, Orono, ME, 04469-5741, USA
E-mail: slindsay@maine.edu

Abstract

Nervous system and sensory structure morphologies provide useful information for reconstructing phylogenetic relationships among the Polychaeta, Annelida, and Arthropoda. With the more common use of indirect immunocytochemistry and laser scanning confocal microscopy methods, the detailed information available from morphological studies has increased. Despite this wealth of information, developing an integrated understanding of the ecology, physiology, morphology, and molecular mechanisms of sensory systems in polychaetes remains a challenge.

For many marine organisms, including polychaetes, chemical signals and chemoreception mediate numerous ecologically important behaviors including defense, reproduction, recruitment, and feeding, yet the mechanism of chemoreception in polychaetes has not been well described. This review summarizes research on the ecology and biology of polychaete chemoreception, particularly as it mediates reproduction, recruitment, and feeding, discusses the chemosensory structures of polychaetes, and describes recent advances in our understanding of chemoreception mechanisms in polychaetes.

Key words: Annelida, *Capitella*, G-protein, deposit-feeding, larval recruitment, olfaction, pheromones, signal transduction

Introduction

As a group, the polychaetes are equipped with an impressive array of sensory structures with which to gain information about their environment (e.g., review by Purschke 2005). Although studies comparing morphology and development of sensory structures have led to new insights about the possible phylogenetic relationships among polychaete taxa, far fewer studies have demonstrated the physiological function and sensitivities of sensory structures. Indeed, the status of polychaete sensory biology was aptly summed up by Purschke (2005): "To date the function of many sensory structures found in polychaetes is still uncertain or completely unknown." Identification of sensory signal transduction pathways in polychaetes lags considerably behind such research in other invertebrate taxa. In one notable exception, the recent work by Arendt et al. (2004) on photoreceptor proteins in *Platynereis dumerilii* Audouin & Milne-Edwards revealed intriguing similarities to vertebrate visual systems and sheds light on the evolution of vision in the metazoa (Fernald 2006).

Comparative chemoreception has emerged as a rich research area (reviewed by Bargmann 2006), yet in terms of examining the neurobiology and evolution of chemoreception mechanisms, research to date has been largely limited to relatively few "model organisms" that do not include many lophotrochozoan taxa (Table 1; Eisthen 2002). Chemoreception is a general term that refers to the

Accepted by N. Maciolek: 20 Apr. 2009; published: 31 Aug. 2009