Investigating the role of myoinhibitory peptide (MIP) signalling in marine larval settlement and metamorphosis

Supervisory team:
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Project description:

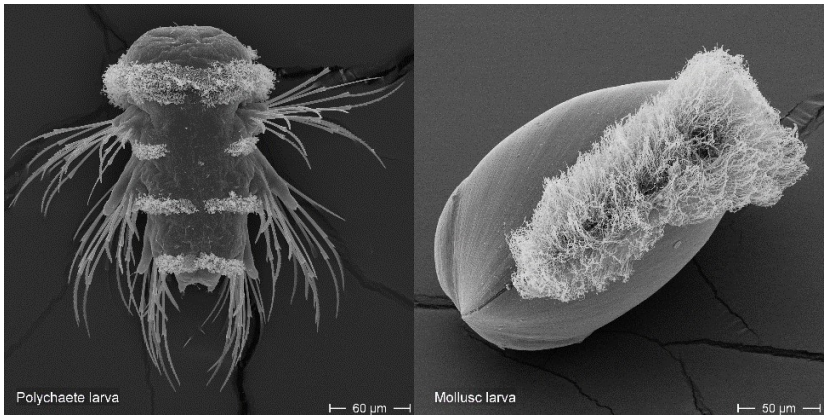

Figure 1. Scanning electron micrographs of polychaete and mollusc larvae. Image credit: Jurgen Berger

In animal nervous systems, neuropeptides are key agents of change. These peptidergic signalling molecules are used to regulate a plethora of biological processes, including reproduction, circadian cycles, behaviour, digestion and excretion. The process of metamorphosis, where dramatic changes in behaviour, physiology and morphology occur within a relatively short time period, is an excellent system with which to study how neuropeptide signalling systems activate or inhibit change in a biological system. In this project, we aim to explore the neuropeptidergic regulation of larval settlement and metamorphosis in the larvae of two different marine invertebrates, the nereid polychaete Platynereis dumerilii, and the Pacific Oyster Crassostrea gigas. We will focus on a neuropeptide known to induce settlement in Platynereis, myoinhibitory peptide (MIP), which was recently found to signal through two different types of receptor, the MIP-gated ion channel (MGIC) and the MIP-activated G protein-coupled receptor (MAG). Through the establishment of MIP receptor mutant lines in Platynereis, we will investigate the contributions of each receptor type to the larval settlement process.

To establish whether the function of MIP in larval settlement and metamorphosis is conserved among other marine invertebrates, we will investigate the expression dynamics of MIP and its receptors during larval development in the Pacific Oyster and test the effect of synthetic MIP peptide on oyster larval development, behaviour and metamorphosis. Results from this project will help to explain how and why neuropeptides signal through multiple receptor types and will increase our understanding of the evolution of neuropeptide signalling. We will also assess whether MIP signalling can be exploited in the context of sustainable aquaculture to enhance and synchronize levels of larval recruitment and growth.

Through this PhD project, the student will gain experience in (1) marine invertebrate culture, reproduction and development, (2) genome editing using the CRISPR/Cas9 system, (3) molecular biology techniques including in situ hybridization and immunohistochemistry, (4) neuroethology and physiology (calcium imaging), and (5) fluorescent confocal microscopy. The student will also benefit from training in experimental design, data analysis, critical thinking, scientific writing and communication.