Coral venom in the era of climate change

Supervisory team:
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Host institution: University of Bristol

Project description:
Due to the global climate change leading to a rise in sea water temperatures, reef building corals tend to lose endosymbionts (coral bleaching) and eventually die. This project is focused on natural adaptations that corals might have evolved to survive short-term bleaching. While corals heavily rely on photosynthetic endosymbionts providing them with sugars, they can also prey on small planktonic animals such as crustaceans. To catch their prey, corals use venom produced by stinging cells (or nematocytes). Venom is mostly composed of proteins and peptide toxins, and its production is regulated according to environmental conditions. Many coral species can be maintained in aquarium facilities.

In this project, you will characterise the role of venom as an evolutionary adaptation to survive short-term bleaching in corals. You will use several cutting-edge molecular and computational techniques as well as behavioural observations of live corals to reveal if venom helps starving bleached corals to survive and if its composition and abundance changes when endosymbionts leave. Using genomics, phylogenetics and molecular clock you will find out when and how the complex coral venom evolved. Feeding experiments with healthy and bleached corals will clarify the venom function at the organismal level. Transcriptomics and proteomics will show how venom composition changes after bleaching, and the most affected components will be further characterised biochemically. You will also contribute to maintenance of the corals in the aquarium facility at the University. Thus, this project will clarify natural strategies that symbiotic reef building corals evolved to survive bleaching. While venom might be a key factor allowing corals to rely on predation during their bleached state, its role and regulation have been completely overlooked.

You will gain a diverse set of skills:

- Bioinformatics: genomics, phylogenetics, molecular clock analysis, transcriptomic data analysis
- Lab work: extraction and characterisation of venom components, RNA extraction and library preparation for RNAseq, molecular cloning, protein expression and purification
- Maintenance of coral culture and work in the aquarium facility
- Planning experiments, presenting your findings, academic writing

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.