Networking algal microbiomes for sustainable aquaculture and biotechnology

Supervisory team:
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Host institution: Cardiff University
Submit applications for this project to Cardiff University

Project description:
Microbial communities underpin the structure and functioning of all ecosystems. They are responsible for producing food and antibiotics, bioremediating pollutants, increasing the efficiency of agriculture and aquaculture, and are central in many other ecosystem services. In isolation, we understand how individual microbes contribute to these natural and industrial processes (e.g., yeasts in brewing), however, we have very limited knowledge of how complex interactions between multiple microbes may enhance or limit such processes. Microbes can interact with one another in many different ways, ranging from mutualistic through to antagonistic. These interactions can be beneficial for humans (e.g., mutualisms between algae and bacteria can lead to enhanced carbon sequestration) or harmful (e.g., production of toxic compounds). Microbial interactions, however, are not constant and may change in both their nature (e.g., mutualistic or antagonistic) and intensity over time, under different environmental conditions (e.g., pH, temperature or nutrient concentrations), or in the presence/absence of other microbes. We need to understand how these interactions, and their effects, vary if we are to harness biological processes.

Here we propose an ambitious studentship focusing on understanding interactions within microbial communities including microalgae, bacteria, and fungi, and their functional implications with a range of potential future applications (e.g., bioremediation, bioprospecting, aquaculture). This project aims to provide fundamental biological knowledge around when and how microbes interact with one another and will centre on the following objectives:

1. Understand the mechanistic basis of microbial interactions (e.g., genes expressed and products generated)
2. Determine the nature and strength of interactions between microbes in natural and industrial systems
3. Examine how interactions affect important biological functions (e.g., carbon sequestration, food production and bioremediation)

There will be significant flexibility in this project, allowing the successful student to focus on a natural or industrial system that interests them. As examples, the supervisors work across sustainable food and feed production in agroecosystems and aquaculture, renewable resources in forestry and bioremediation, and biotechnology and bioprospecting for health by using data-intensive research and developing novel technology and bioengineering.

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.