To kill or not to kill: deciphering the metabolic triggers of a facultative algicidal bacterium Ponticoccus

Supervisory team:

Main supervisor: Dr Katherine Helliwell (University of Exeter)

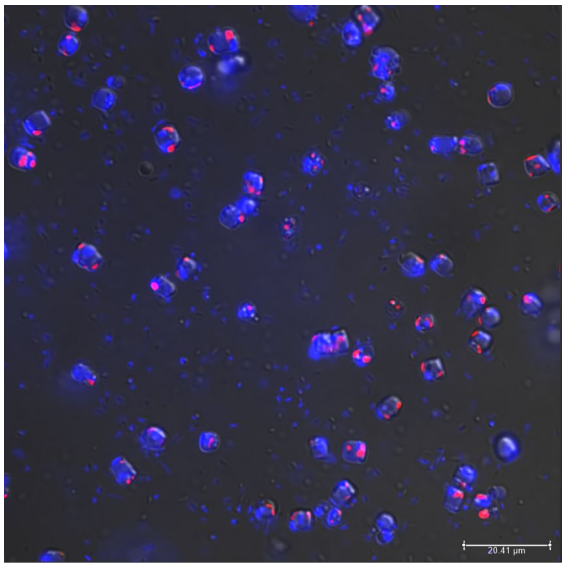
Second supervisor: Prof Nicholas Smirnoff (University of Exeter)

Associate Professor Michael Cunliffe (Marine Biological Association),

Dr Adam Monier (University of Exeter), Dr Glen Wheeler (Marine Biological Association)

Host institution: University of Exeter (Streatham)

Project description:



Diatoms account for 20% of global primary production, support key fisheries, and are a major sink for rising atmospheric CO2. These organisms also have great potential as a feedstock for the production of high-value products and biofuel. It is thus critical to better understand factors controlling diatom growth, physiology and metabolism. We are becoming increasingly aware of the importance of biotic interactions between diatoms and other microbes in regulating diatom growth, although very few have been characterised directly. This project builds on our recent environmental survey to discover bacteria that interact with diatoms. This work led to the identification of a facultative algicidal bacterium, Ponticoccus, which can kill diatoms in a species-specific manner. Our experiments have shown that the algicidal lifestyle of Ponticoccus is activated only under certain growth conditions, suggesting that a metabolic switch controls pathogenicity of this bacterium. However, e currently do not understand how P. alexandrii causes diatom cell death, what mechanisms govern the switch to a pathogenic lifestyle, or how conserved such mechanisms are across different algicidal bacteria.

This PhD will employ our new model system to:

i) conduct a range of algal-bacterial co-culture experiments to determine the environmental signalling mechanisms controlling bacterial pathogenicity,
ii) employ biochemical and metabolomics approaches to decipher the molecular basis for algicidal activity,
iii) examine existing genome and transcriptome datasets to assess the presence and conservation of algicidal pathways in Ponticoccus and other antagonist bacteria.

This work will significantly advance understanding of how environmental factors shape the nature of biotic interactions between marine microbes, and provide important new insight of the molecular mechanisms underlying of such interactions. By studying the mechanistic basis of antagonistic algal-bacterial interactions, this project could lead to the identification of novel anti-microbials for medicine and biotechnology. Additionally, this work will provide fundamental new insight of environmentally relevant algal-bacterial interactions that are likely a significant driver of ocean carbon cycling. Finally, this project offers an exciting opportunity to gain training in a broad range of laboratory techniques spanning microbiology, genomics, physiology, metabolism and biochemistry, utilising diverse expertise from the University of Exeter and MBA.

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.