

2024_88_DoLS_TB: Role of Symbiotic Microbes in Regulating Phytoplankton Growth and Future Ocean Carbon Storage

Supervisors: Professor Tom Bell (<mailto:thomas.bell@imperial.ac.uk>); Dr Fengjie Liu, Grantham Institute/Department of Life Sciences, Dr Andrew Shevchuk, Faculty of Medicine

Department: Department of Life Sciences

A fundamental process controlling atmospheric CO₂ levels and primary productivity is the biological fixation of CO₂ and N₂ by marine phytoplankton, and their growth is strongly influenced by other smaller microbes such as bacteria and fungi living in the phycosphere, a micrometer scale space which directly surrounds phytoplankton cells.

The phycosphere microbiota has broad impacts, including the exchange of nutrients, metabolites and info-chemicals with the host phytoplankton cells. The importance of the phycosphere microbiota has been a puzzle for four decades, yet only recently have novel nano-technology based tools made it possible to open the black box of the unique micro-environment.

Currently, this is a key knowledge gap which is partly responsible for the large error in predicting oceanic carbon budget, and climate models are not fully accounting for their impact.

This project is carefully designed to produce new understanding of phytoplankton-bacteria interactions. Using an interdisciplinary approach including Bio-physics, Microbiology and Oceanography, this project will aim to (1) identify the phycosphere microbes in major groups of marine eukaryotic phytoplankton via novel nano-probes and single-cell sequencing method; (2) quantify growth effects of the phycosphere microbes on the host phytoplankton and underlying mechanisms; and (3) investigate how the community of phycosphere microbes evolve in a warmer and acidifying ocean.

Such knowledge is an essential component for predicting future ocean carbon storage and productivity in a changing climate.

The student will get trained on novel nano-technology based tools, state-of-the-art methods for single cell sequencing, and they will have the opportunity to participate in oceanographic research cruise(s).

The student will be expected to attend national and international conferences and publish their research. They will also benefit from a career development PhD training program at Imperial College.

This project is directly linked to the newly launched Leverhulme Centre for the Holobiont led by T. Bell, which aims to map the associations between microbes and host organisms. Also, it is closely aligned with the ongoing NERC project of F. Liu on how marine bacteria in the phycosphere of diatoms alter iron bioavailability.

For more information on how to apply to us please visit: <https://www.imperial.ac.uk/grantham/education>