

Master thesis project:

‘The effects of hypoxia on single phytoplankton cells’

Background

Phytoplankton, oceanic photosynthetic unicells, contribute approximately 50% of the world’s primary production and form the basis of all aquatic food webs. In the ocean phytoplankton are periodically exposed to oxygen (O_2) at levels below their biological O_2 demand (‘hypoxia’), which can negatively affect their photosynthesis, productivity and overall ability to cope with additional stressors (e.g. pollution, temperature). The magnitude and frequency of hypoxic events is increasing - primarily due to ocean warming and coastal eutrophication- and is predicted to reach historically unprecedented levels in the 21’st century. To understand phytoplankton responses to current and future levels of hypoxia, the student will investigate how different O_2 levels affect phytoplankton photophysiology, and whether individual cells demonstrate varying abilities to recover from hypoxia. To do these experiments at a single cell resolution, the student will employ cutting-edge microfluidic systems and high-fidelity gas mixing in combination with advanced single cell microscopy techniques. The data gained from this project will significantly advance our understanding of the effects of hypoxia on important oceanic primary producers.

Master-thesis project description and aims

In this master thesis, you will create hypoxic environments within (available) microfluidic devices and be responsible to establish gas mixing procedures and measure O_2 levels. You will categorize the response of single phytoplankton cells to these hypoxic environments via advanced microscopic fluorometry imaging.

Methods

In this project, you will employ the following methods/equipment:

- Microbiological cultivation
- Automated gas mixing using high-precision mass flow controllers
- Oxygen sensing using optical O_2 sensors
- Microfluidic devices for the creation of gaseous environments
- Advanced chlorophyll fluorometry imaging

You should be a master-level student with a strong background in (ideally) microfluidics, microbiology, finite-element modeling, O_2 sensing and/or numerical methods.

Students from all walks of life and backgrounds are welcome to apply!

Have a look at what else we are up to: <https://behrendtlab.com/>

Interested? Please contact Lars Behrendt, lars.behrendt@scilifelab.uu.se. The scope of the project is a 30-45 hp master thesis