Proposition de stage de Master 1
Institut de Physique de Nice — UMR 7010 CNRS UCA

Impact of lithium on microorganisms using microfluidics Technologies

Topics: microfluidics, microswimmers, biophysics of microorganisms, data analysis, active matter, ocean pollution.

Lithium : an emerging but still poorly understood contaminant. The natural biodiversity of coastal ecosystems is exceptional. However, coastal waters receive pollutants of terrestrial origin, largely via rivers draining intensely anthropized regions. Trace metals, along with plastics and organic matter, are the source of observable contamination in relation to coastal or inland anthropogenic activities.
Among trace metals, lithium (Li) is a strategic metal with one of the highest annual increases (18%) in global demand. Li is an essential component of popular high-tech objects (smartphones, laptops). As part of the energy transition, energy storage systems are being set up and "gigafactories" are being built on various continents to produce hundreds of millions of electric vehicles equipped with lithium batteries. However, little is known about its levels in the environment and in biota.

Recently, we have developed **an interdisciplinary approach** with biologists and chemists (LOV, Villefranche-sur-mer), physicists (MIMIC and MNM team at INPHYNI, Nice) and a start-up (KLEARIA, Nice). This project focuses on the *in situ* detection of Li, combined with characterization of the impact of Li on microorganisms.
This internship is directly linked to this project. It will focus on the study of a particular swimmer (a microalgae), in a microfluidic device.
Initially, the microfluidic device will be a simple channel in which we will observe the microorganism swimming, without lithium, then with different concentrations of lithium, or after subjecting the microorganism to different doses of lithium for a certain time.

The swimming pattern will be characterized by tracking the organisms, enabling their trajectory to be reconstructed. From these trajectories, various parameters such as instantaneous speed or directionality can be calculated.
Secondly, we will look for other analysis tools that can quantitatively demonstrate changes in the swimming behavior of organisms due to the presence of lithium.
The internship will therefore have three components:

- -an experimental part, with preparation of microfluidic samples in a clean room, and microscopy using an inversed microscope.
- -data processing using ImageJ and programs written in Python
- -research and implementation of trajectory analysis tools.

The experimental protocol and results obtained will be discussed in collaboration with the team in LOV at Villefranche-sur-mer.

Supervisors:

Philippe THOMEN / 04 89 15 28 57 / Philippe.THOMEN@univ-cotedazur.fr
Xavier NOBLIN / 04 89 15 28 25 / Xavier.NOBLIN@univ-cotedazur.fr