Microfluidic devices to study microalgae metal pollution

Master/Semester project

in collaboration with CEA Grenoble - LPCV lab (https://www.lpcv.fr/)

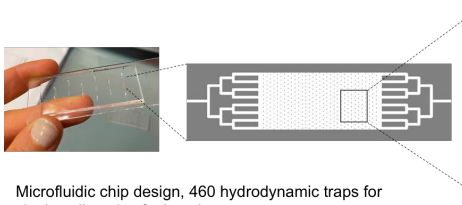
(Section: Microengineering – Physics – Electric Engineering – Life Science)

Pollution of terrestrial and aquatic ecosystems by heavy metals is a major and ever-growing threat to environmental and human health. A better understanding of the effects of toxic elements on land plants and microalgae is critical to develop approaches for treating contaminated environments using phytoremediation processes[1].

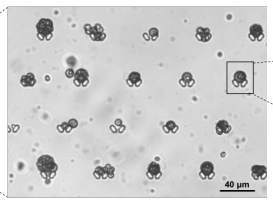
The main objective of this project is to study the tolerance and accumulation of metals in a metal-hypertolerant green microalga of the Coelastrella genus. To do so, we plan to develop microfluidic devices[2] for high-throughput screening of metal tolerance in this microalga. Your task will be to fabricate and characterize PDMS chips for single alga trapping that will later be used in fluorescence microscopic studies. You will work on a multidisciplinary project and start from literature and design, going to fabrication in the clean-room, experimental testing, and finally analysis. You will learn cell culture techniques, microfabrication, critical thinking and experimental know-how.

Prerequisites:

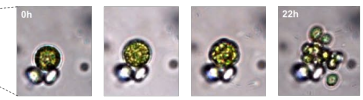
- Interest for biological applications and microtechnology with background in one of them. Prior training in nano/micro- fabrication is an advantage
- Independent and willing to have fun in the lab
- Master projects will be preferred



Microfluidic chip design, 460 hydrodynamic traps for single cell study of microalgae



Zoom on a loaded chip



22 hours time-lapse showing on-chip microalgae culture and cell division (no metal pollution).

References:

1. Muthusaravanan, S. *et al.* Phytoremediation of heavy metals: mechanisms, methods and enhancements. *Environmental Chemistry Letters* 16, 1339–1359 (2018).

2. Kim, H. S., Weiss, T. L., Thapa, H. R., Devarenne, T. P. & Han, A. A microfluidic photobioreactor array

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