
PhD proposal

(April 2018)

Lab-On-Chip integrating whole-cell biosensors for early water contamination detection

Location: INL, Lyon, Claude Bernard University (France)

**Supervision: P. Kleimann, J-F Chateaux and L. Renaud (INL, Lyon)
C. Durrieu (LEHNA, Vaulx-en-Velin)**

Context:

The Lab-On-Chip & Instrumentation team (LOCI) of the Institute of Nanotechnologies of Lyon (INL, UMR CNRS 5270, <http://inl.cnrs.fr/>) is specialized in the development of Lab-on-Chips and dedicated instrumentation for health and environment. This 8-person team relies on the NanoLyon technology platform (clean rooms for micro / nano-fabrication and characterization) and on a cell culture and manipulation laboratory to carry out its work. Three years ago, our team started a strong collaboration with the Laboratory of Ecology of Natural and Anthropised Hydrosystems (LEHNA, UMR CNRS 5023, Vaulx-en-Velin). This laboratory is specialized in the development of whole-cell biosensors, in this case unicellular algae, for the monitoring of surface water contamination. Many bio-markers can be monitored to evaluate changes in algae physiology related to exposition to toxicants (pesticides, heavy metals, pharmaceutical drugs...). Such of them are for example cellular membrane permeability, enzymes activity, O₂ production or chlorophyll fluorescence. The purpose of this collaboration is the creation of new tools combining these biosensors with Lab-On-Chip technology for on the field detection of pollutants in water samples. By this approach we want to address the need for environmental monitoring with shorter sample pickup period and finer mapping that only a low cost and easy to use tool can allow. This tool will be an early warning system enabling to focus human and financial resources (chemical analysis and ecotoxicological laboratory tests) when the need arises.

Objectives:

The objectives of this PhD thesis are both scientific and technological. On one hand, the PhD student will have to develop microfluidic systems (cell-on-chip) and to use them to characterize the response of various algae species to different pollutants. Some data are already available but by extending our knowledge over a larger range of algae species and pollutants, it is expected to develop a multi-species biosensor given some insights about the nature of the contamination. The PhD student will also have to implement and evaluate some strategies to optimize or increase the sensitivity of these biosensors. Monitoring of the photosynthetic system through fluorescence measurements will be considered first.

The complementary main objective is related to the development of a new portable instrument integrating these algae biosensors for on-the-field water contamination monitoring. A first generation of such an apparatus has been developed at INL and is based on algae chlorophyll fluorescence measurement (fig 1). The system has been successfully qualified by the LEHNA. Encouraged by this success and to go a step further, we want to develop a much more advanced device fully exploiting the Lab-On-Chip capabilities. The PhD student will be in charge of the development of this Lab-On-Chip device using more specifically the Lab-On-Disc (centrifugal microfluidics) approach.

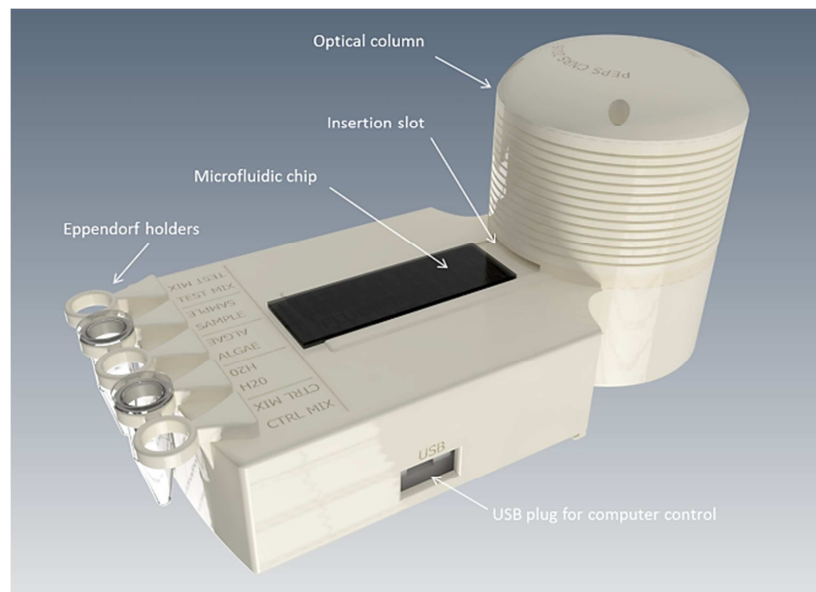


Figure 1: Portable system developed at INL for chlorophyll fluorescence measurement of micro-algae embedded into a microfluidic chip.

Qualifications required:

Ideally, the candidate will hold a master degree in the field of micro / nanotechnologies, a first experience (M1 or M2 internship) in microfluidics would be a plus. However, more physics, instrumentation or biosensor oriented profiles may be considered. In any case, the candidate must have a predilection for experimental work in clean room and with biological related material.

Financial support:

This doctoral position is supported by a scholarship from Claude Bernard University. The success in obtaining this scholarship is strongly conditioned by the high academic quality of the candidate (profile, master's notes, quality of the recruitment interview).

How to apply:

Send as soon as possible (and before mid-May, 2018) a CV and a covering letter to jean-francois.chateaux@univ-lyon1.fr and louis.renaud@univ-lyon1.fr.