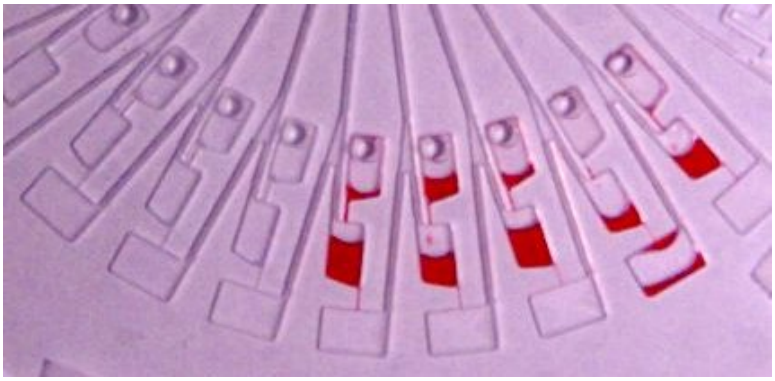
PhD fellowship position in Engineering Science

"ChipOmics" project (SPW Walloon Region win2wal, 2.2M€ grant)

Microfluidic-based sample preparation for single-cell proteomics

A 4-year position for a PhD fellowship is available at the Microfluidics Lab @ University of Liège, Belgium (Tristan Gilet). It is open in the framework of the 4-year research project ChipOmics funded by the Walloon Region, in partnership with the Mass Spectrometry Laboratory @ ULiège (Gabriel Mazzucchelli), the GIGA Stem Cells group @ ULiège (Laurent Nguyen), the research center Sirris and the epigenetics company Diagenode.



Liquid motion inside the chambers and channels of a rotating microfluidic chip, in response to centrifugal and capillary forces. Credit: Microfluidics Lab @ ULiège.

In vitro models of human organs and tissues can be built through the differentiation of human-induced pluripotent stem cells. These models are key to the development of cell therapy, cancer science, immunology and personalized medicine. Each cell contains a unique proteome (collection of proteins) that defines its functional state and that evolves over time. It can be determined thanks to mass spectrometry. In order to understand and control the differentiation process, we need to access this proteome for each cell separately. Single-cell proteomics is much more challenging than single-cell genomics or transcriptomics, owing to the impossibility to amplify the tiny amount of proteins in each cell. A promising solution to proteomics at the single-cell level would be to downscale the sample preparation steps. It would minimize the loss of biological material and increase the yield of chemical and enzymatic reactions.

The ChipOmics project aims at developing a disposable microfluidic chip that can robustly perform sample preparation workflows for quantitative single cell

proteomics. The main specificity of this chip is that it will only be interfaced with standard lab instruments. The liquid samples and reagents will flow therein in response to controlled centrifugal and capillary forces (cf. figure above).

In this PhD project, the student is asked to design and test this microfluidic chip. The development is an iterative process involving three main steps: (1) identification of a chip architecture that implements the requested workflows, (2) design of the chip geometry and modeling of the microscale flows through the channels and chambers therein, and (3) experimental characterization of both these microscale flows and the subsequent robustness of the performed fluidic operations. The student will have to interact constantly with all the partners of this multidisciplinary project.

Person specification

- Master's degree in engineering or physical sciences
  (graduation in 2019 or 2020)
- Required knowledge: Small-scale fluid dynamics
- Appreciated knowledge: Analytical chemistry, optics, physical chemistry
- Required skills: Lumped-element modeling, Matlab or Python, English (fluent)
- Appreciated skills: Image processing, instrument interface, AutoCAD, French
- Interest in microfluidics, lab-on-a-chip, biology and "omics".
- Interest in experimental research, mechanical design and physical modeling
- Good relational skills, ability to communicate on technical contents with both experts and non-experts.

The PhD student will work at the Microfluidics Lab (ULiège) under the supervision of Professor Tristan Gilet, in close collaboration with all the project partners. The student will be employed for maximum four years, with a yearly evaluation from a PhD committee. The student will register to the doctoral school in engineering science at ULiege, and may obtain a PhD degree by 2024.

Interested people should email the following documents to Tristan Gilet before December 31, 2020: cover letter, resume, transcript of grades & ranking and any other document that may be useful to support the application (e.g. publications, master's thesis, project report). They should also provide the name, affiliation, email address and phone number of two professors (possibly including the Master's thesis advisor) who will be asked to provide recommendation. Finally, non-EU applicants have to join a European equivalent of their Master's diploma. Short-listed applicants will be invited to a videoconference interview in early January 2021. The interview will include a short test on the required knowledge and skills listed above. The appointment should start between February 1 and March 31, 2021.

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