



## PHD THESIS POSITION

### *Title:*

**Lab-in-Droplet for glycoprotein biomarker discovery: from device conception towards diagnostic applications**

**Host Institution :** Institut Galien Paris Sud, UMR CNRS 8612, Team of Professor Myriam TAVERNA  
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[http://www.umr-cnrs8612.u-psud.fr/presentation\\_pers.php?nom=mai](http://www.umr-cnrs8612.u-psud.fr/presentation_pers.php?nom=mai)

### **Context:**

The PhD position is granted by the *Agence Nationale de la Recherche* (ANR) for 36 months starting from 1st April 2019.

### **Project Description:**

This project aims to develop a novel analytical platform (both concept and instrumentation) that hyphenates different analytical techniques (i.e. sample enrichment, matrix removal and analyte separation) around tiny droplets of biological samples. This innovative platform (named hereafter Lab-in-Droplet) will integrate in a sequence of droplets different steps, including i) immuno-enrichment / purification of target analytes onto magnetic beads functionalized with antibodies [1] and ii) electrokinetic separation of enriched / purified species upon application of a high voltage over a droplet (hereafter named 'digital capillary electrophoresis', DCE) ( Fig. 1). This will be the first compact platform able to couple fluidic sample treatment and analyte separation modules without any problem of working volume mismatch, thus solving the instrumental and methodological bottlenecks currently encountered in analytical module integration. The platform will aim at high throughput analyses with no operational cross contamination. In this project, this platform will be applied for analysis of glycans from human transferrin (Tf), an abundant plasma protein, serving as biomarkers for diagnosis of chronic alcohol abuse [2] and for the screening of Congenital Disorders of Glycosylation (CDGs) [3]. In a larger application scope, the Lab-in-Droplet platform will be used for elucidation of glycosylation patterns, serving for both biomarker discovery and pathogenesis unraveling.

The PhD student will develop the DCE system and protocols for fast and efficient removal of glycans from proteins and for their separation and detection. These protocols that will be based on recent achievements in our group, will be adapted to the droplet format. The PhD student will try to propose different ways for the coupling of DCE with magnetic-bead-based immuno-capture in droplets for extraction and analysis of glycans from human plasma transferrin. The PhD student will then demonstrate the applicability of the developed system and methodology with several plasma samples from patients suffering either from chronic alcoholism or CDG. The information on plasma Tf glycans will be used to correlate with the respective patient / healthy persons, to draw conclusions on the significance of the Tf glycans profile for chronic alcoholism diagnosis and / or CDG (type 1) screening.

The PhD student will be supported by a multidisciplinary collaboration network that has been established for the project, with one partner from Hopital Bichat (Paris) for glycan-based diagnosis, one from Institute Curie (Paris) for droplet-based operation and microfluidics and one from University of Basel (Switzerland) for instrumentation design and construction.

## QUALIFICATION

- You are highly motivated to work at the boundary between analytical chemistry, microfluidics, instrumentation and nanotechnology.
- You have a master's degree or equivalent (obtained since within 4 years) in either Instrumentation and Analytical Chemistry / Nanosciences / Microfluidics
- You have practical experience in microfluidics and/or instrumentation and/or microfabrication, with a good sense of analytical chemistry
- Good knowledge about biochemistry / biology, particularly immunoassays / diagnosis / biomarkers is advantageous.
- You have strong communication and presentation skills in English (verbal and written)
- You enjoy working independently and challenging scientific obstacles with an optimist aptitude.

Send your application by e-mail to [thanh-duc.mai@u-psud.fr](mailto:thanh-duc.mai@u-psud.fr) including CV with names and addresses of two referees and motivation letter

### Refs:

- [1] T.D. Mai, D. Ferraro, N. Aboud, R. Renault, M. Serra, N.T. Tran, J.-L. Viovy, C. Smadja, S. Descroix, M. Taverna, Single-step immunoassays and microfluidic droplet operation: Towards a versatile approach for detection of amyloid-beta peptide-based biomarkers of Alzheimer's disease, *Sens. Actuators B*, 255 (2018) 2126-2135.
- [2] I. Kohler, M. Augsburg, S. Rudaz, J. Schappler, New insights in carbohydrate-deficient transferrin analysis with capillary electrophoresis - mass spectrometry, *Forensic Sci. Int.*, 243 (2014) 14-22.
- [3] K. Scott, T. Gadomski, T. Kozicz, E. Morava, Congenital disorders of glycosylation: new defects and still counting, *J. Inherit. Metab. Dis.*, 37 (2014) 609-617.



Fig. 1: Lab-in-Droplet concept for glycan patterning