LMGP
Laboratoire des matériaux et du génie physique
une vision des matériaux

2015-2016

Internship proposal (Master 2 or final internship) at the LMGP

Development of an innovative washing method combining Macro and micro-magnetic fields. Application to immunoassays

Context

Micro- and nanotechnologies have many biomedical applications, such as in *in vitro* diagnostic. The MagIA project uses micro-magnet arrays and superparamagnetic nanoparticles (nano-SPM) to develop **fast, sensitive and reproducible** immune-assays. Recently, we have developed a 15 min one wash cycle magnetic immunoassay. This test has the same sensitivity as a 6h long ELISA.

Washing steps commonly performed in the lab are one of the major bottlenecks in point-of-care (POC) development since this requires non-trivial fluid handling methods. Nevertheless, washing steps are essential because they guarantee the specificity of the assay by the separation of bound and unbound detection labels.

In this context, a recently patented concept which combines a *macro* magnetic field and a *micro* magnetic field allows this separation without fluid handling. The goal of this project is to develop a magnetic immunoassay with no external fluidic manipulation. This new kind of system will combine **micro**-magnet arrays, particularly interesting because they allow efficient trapping of superparamagnetic **nano**particles, and a Macro magnetic field source based on a bulk permanent magnet or an electro-magnet.

Project

Immunoassays use antibodies as specific capture and detection molecules, to recognize a molecule of interest in a solution. In this present project, proteins to be detected will be magnetically labelled with nanoparticles, then captured by micromagnets and attached to the surface thanks to strong antigen-antibody interactions. Nanoparticles that don't carry any proteins will be released thanks to a "magnetic washing" step, in which a macroscopic field source is used to locally modify the magnetic landscape around the micro-magnets. The measurement of nanoparticles at the surface of micromagnets will be related to the concentration of the molecule of interest.

Objectives of the project are:

- Demonstrate the possibility of magnetic washing.
- Adapt and optimize micro-magnet arrays and the macro magnetic field source to enhance washing performance.
- Explore different methods to measure the amount of magnetic material captured, in relation to the amount of antigen to detect

Competences

The candidate should be an engineer or master student trained in applied physics, electromagnetism, biology.

Time and place

This research topic is a collaborative project involving several Grenoble-based labs: G2ELab (Orphée Cugat, Paul Kauffmann), LMGP (Marianne Weidenhaupt, Franz Bruckert), Institut Néel (Thibaut Devillers, Nora Dempsey), and Institut Albert Bonniot (Patrice Marche, Sarah Delshadi).

Experiments will be performed at the CIME nanotech biological platform.

Web site of the lab: http://www.lmgp.grenoble-inp.fr/
Web site of the project : http://www.immunomag.com/

PhD possible : YES

Internship stipend : 554€ per month

Contact

Paul Kauffmann
Paul.kauffmann@g2elab.grenoble-inp.fr

Sarah Delshadi
Sarah.delshadi@g2elab.grenoble-inp.fr