2015-2016

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

Development of a no-wash immuno-assay combining magnetic nanoparticles and micro-magnet arrays

Context

Micro- and nanotechnologies have many biomedical applications, such as in *in vitro* diagnostic. In this project, micro-magnet arrays are used to develop **no-wash** immuno-assays. Combined with fluorescent detection, such set-ups will unite specificity, sensitivity, robustness and ease of detection in a dedicated lab-on-chip technology.

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. They are hardly reproducible at micro and nano-scale and may wash out antibodies, especially those of low-medium affinity like many monoclonal antibodies, commonly used on a benchtop lab analysis.

In this context**, micro**-magnet arrays are particularly interesting because they allow efficient trapping of superparamagnetic **nano**particles. We have patented an innovative technology to fabricate micro-magnet arrays that are now being used to develop fast immuno-assays that take advantage of the radical size reduction, compared to commercial technology. Surface reaction is increased and incubation time is reduced compared to experiments based on the use of microparticles or microplates. Moreover, local capture of immune-complexes allows for a differential measurement between the non-specific background signal (where there is no micro-magnet), and the specific one (where there are micro-magnets).

Project

Immunoassays use antibodies as specific capture and detection molecules, to recognize a molecule of interest in a solution. Fluorescent detection will be developed to quantify a molecule without any washing steps. The structure of micro-magnet arrays will be optimized to allow the capture of superparamagnetic nanoparticles functionalized with specific antibodies and to simplify the detection.

Objectives of the project are:

- Develop a no-wash immunoassay using fluorescent detection. This immunoassay can be performed in a scanning fluorimeter or under a microscope. In both cases, signal processing has to be optimized to guarantee a good linear range and sensitivity.
- Adapt and optimize micro-magnet arrays and biological conditions to enhance the performance of the test. This step will permit the optimal use of low affinity antibodies.
- Design a benchtop analyzer able to perform the test.

Competences

The candidate should be an engineer or master student trained in applied physics, physico-chemistry, biology. Some knowledge in image processing or signal processing will be appreciated.

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

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