PhD Grants 2014

Fast point-of-care diagnostic immuno-assay exploiting magnetic nanoparticles, structured µ-magnet arrays, and integrated electrochemical µ-detectors

Principal investigators

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We develop immunoassays exploiting magnetic nanoparticles, micro-magnets, and integrated electrochemical detection. Micro-magnets will be produced and their surface functionalized, to allow the detection of a protein using super-paramagnetic coated nanoparticles. The objectives are (i) to adapt the micro-magnet arrays to various detection modes, (ii) to measure sensitivity & specificity of the detection, (iii) to study possible interferences between magnetic fields and electrochemistry. The results will open the way to the development of dedicated diagnostic lab-on-chip.

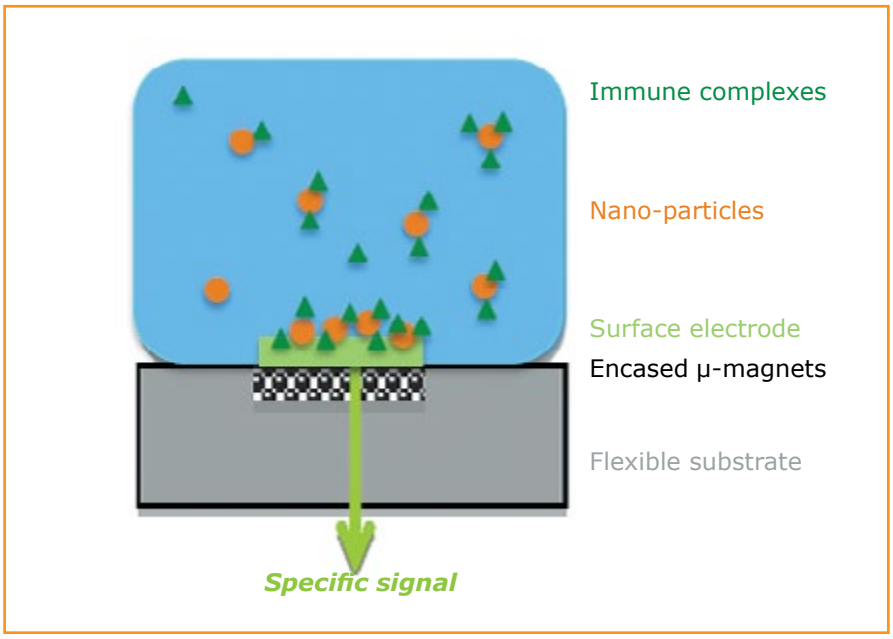
Description

Magnetic attraction is widely used in biotechnology, because it provides long-range forces able to capture molecules or cells of interest. Micro-magnet arrays from InstitutNéel are particularly interesting because they can efficiently trap super-paramagnetic nanoparticles, thanks to their high local gradients. This innovative technology is now used to develop fast immuno-assays that take advantage of a radical size reduction, compared to commercial technology. Immuno-assays use antibodies as specific capture & detection molecules, in order to recognize a protein of interest.

The objective of this project is to design and optimize portable devices for the fast simultaneous detection of multiple immune complexes.

We will functionalize the upper surface of micro-magnet arrays with electrodes. Electrodes at the surface of micro-magnet arrays will be used to detect immune complexes of interest. Once the detection method is optimized using pure proteins, the results will be validated using animal serum.

A full comparison of the device performance will be performed. Various modes of detection will be tested,mainly optical and electro-chemical. We will compare the detection limit, the response range and reproducibility of this new assay with routine assays (ELISA tests) performed on automated analytical instruments.



Electrochemical detection of magnetically captured immune complexes. Functionalized nanoparticles are concentrated on the surface electrode by micro-magnets. They carry immunologic complexes (triangles) which are detected electrochemically

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