

## **Magnetic Biochip platform for water and liquid contaminant detection**

### Proposers

Susana Freitas (INESC-MN) and Luís Fonseca (IBB)

Several recent lethal outbreaks remind us that food-borne infections remain an important public health problem. Worldwide, several cases of food poisoning are reported in a daily base by the most common food-borne pathogens, and have motivated research on rapid and reliable detection methods. The most important requirements are the detection limit, the time of analysis (within hours up to a maximum of 24 h), the sensitivity and specificity, and the validation of the rapid detection method. Commercially available detection methods are still not ideal. Traditional microbiological methods are often coupled with an upstream concentration step starting from large volumes of sample material. In some systems a pre-enrichment step using selective media follows sample concentration, taking long time (up to 5 days), while faster diagnostic methods are bulky instruments that require the operation by well-trained staff in a centralized location.

The work consists on the development of a portable platform for in-situ rapid and sensitive detection of pathogens in water, using magnetoresistive sensors with microfluidics for dynamic measurement. It includes the design, fabrication and testing of a simple sample preparation (separation/concentration) method based on magnetophoresis, using electrical current or permanent magnet approaches.

The doctoral student will be involved on the design, development and validation of a spintronics-based biosensing platform included in the concept of lab-on-a-chip. The system will make use of high affinity ligands for pathogen capture, antibodies and/or DNA-aptamers, which are short single-stranded DNA oligonucleotides, selected in vitro based on their high affinity and specificity for the target species. The aptamers will be immobilized on magnetic nanoparticles and used to capture and label specific pathogen microorganisms, for the analysis of water and liquid food.

A microfluidic system will be designed to concentrate and separate magnetically-labeled pathogens from the original complex sample matrices, without prior enrichment and in a reagent free system. After separation the conjugates (magnetic particle/pathogen) will be loaded into a subsequent microfluidic channel to be detected in flow motion by integrated MR sensors and quantified with high sensitivity.

*Profile sought: preference, but not limited, to students with a background in Biology and Biomedical Engineering with an interest in Physics, Devices, and Micro and Nanofabrication.*