Capillary microfluidic biochips

Proposers

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Introduction

Lab-on-chip biosensing devices have gathered much attention as they have the promise of achieving point-of-care/point-of-use quantification of relevant biomarkers for human or animal health, food processing and food safety, and environmental applications. Microfluidic systems have the potential to revolutionize point-of-use biological and chemical analysis, but to fulfill their potential they must be inexpensive and easy to use. Capillary microfluidic chips are promising to achieve this goal because, by profiting from the large surface-to-volume ratio in miniaturizes systems, there is not need for external pumping to move the fluids. Nevertheless, important challenges remain, related to achieving true simplicity of operation that allows operation by untrained operators, integration of reactants in the chip, ability to perform complex and multiple fluidic operations, and high sensitivity detection without special instrumentation.

Partner 1

The Thin-Film MEMS and BioMEMS group at INESC MN (www.inesc-mn.pt) has extensive experience developing and PDMS-based microfluidics for biosensing, cell-chips, and separation of bioproducts. Particular recent focus has been on integrated sample preparation modules, optical detection, and the use of nanoporous microbeads.

Partner 2

Laboratório de Análises do Instituto Superior Técnico (LAIST) is a reference analytical laboratory with extensive experience in microbiological analysis. Nowadays, the microbiology unit of LAIST divides its focus between routine analysis and research, being a frequent partner of European projects and brings to this particular project the know-how in gold standard procedures to benchmark the microdevices.

Project outline/goal

In this project, we propose to use microfluidics technology to develop a PORTABLE MICROFLUIDIC CAPILLARY SYSTEM to address the need to analyze a set of target molecules directly from the sample at the point-of-use. The model systems will be, for example, antibodies in blood samples, biomarkers of infection in plants and microbiological contaminants in different applications. This project will significantly advance the current technology with the following developments: (i) integration of different fluidic operations in a single capillary chip, namely sample preparation and target concentration/amplification; (ii) on-chip storage of reactants to simplify fluidic handling with the aim that sample insertion in the chip is the only external fluidic handling; (iii) advanced fluidics to control flow rates and residence times in different parts of the chip; and (iv) optical signal acquisition with a cellular phone.

Student profile

Profile sought: preference, but not limited, to students with a background in Biomedical Engineering, Biological Engineering or Biotechnology with an interest in exploring complex microfluidic systems for practical applications. Experience in Micro and Nanofabrication would be helpful.