

COLLABORATIVE IBEC INTERNATIONAL PhD PROGRAMME

Position

1. Project Title:

Detection and Isolation of Rare-Cells from Blood using a Microfluidic Device

2. Research project/ Research Group description

This project aims to develop an integrated and compact microfluidic device to detect and isolate rare cells from blood samples with high specificity. The ability to capture rare cells from blood is an important challenge in biomedicine as they constitute biomarkers for multiple health conditions (1). In particular, the detection and analysis of circulating tumor cells (CTCs) is of vital importance to diagnose a tumor and monitor cancer progression, as well as to account for tumor heterogeneity.

The device will comprise different processing units to account for sorting, detection, enumeration and purification of the target cells. The project is conceived as a collaboration between the two research institutions (IBEC and ICMS), where each of the centers will contribute with their experimental facilities and know-how. In particular, the two research groups involved will be the “Nanobioengineering Group” at the Institute for Bioengineering of Catalonia (IBEC), led by Full Professor Josep Samitier and the “Microsystems Group” at the Institute for Complex Molecular Systems (ICMS), led by Full Professor Jaap den Toonder.

The Nanobioengineering group will be in charge of developing a size-based pre-sorting unit based on inertial forces that will separate the sample content (cells and particles) into size fractions. This processing will act as a pre-purification step that will make it possible to perform the subsequent cell detection and analysis. The Nanobioengineering group has extensive experience of over 15 years in the development of microfluidic devices for biological applications.

A further “Detection & Enumeration” step is envisioned for the project. This operation unit will use the cell fraction separated in the previous step to discriminate cell types based on the electrical impedance spectroscopy readout of single cells transiting through a specifically designed electrode detection area. This processing unit will enable to discriminate specific rare cells from the fraction of blood cells with a similar size, based on their impedance profile. This second processing unit will be developed and fabricated in the Microsystems Group at ICMS.

A final step will further purify the sample by implementing an electrical cell sorter based on dielectrophoretic forces to collect the rare cells and discard the other cells. This last step will be developed also by IBEC.

3. Job position description

The PhD candidate should hold a bachelor and/or master's degree in physics, chemistry, electrical engineering, biomedical engineering or related areas. Experience in the development and/or handling of microfluidic devices will be highly valued.

The PhD candidate will work between both research centers and will benefit from the expertise and facilities at both ends. The candidate should enjoy working in a multidisciplinary work environment both at IBEC and at ICMS.

The candidate will take care of designing, developing and testing of the different device units as well as the integration of the whole system. It is also expected that the device will be used in clinical settings with real patient samples. In this case, the candidate will work in close collaboration with different hospitals and clinical research centers.

Group Leader at IBEC

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