PhD Proposal
High-throughput identification of circulating cancer cells using biophysical signature

A PhD grant is offered with a support by I-site and The University of Lille to perform the entitled project starting **on October 2018** for a duration of 3 years. The project will be carried on within **SMMiL-E** (located at Institut pour la Recherche sur le Cancer de Lille, http://limmshp.iis.u-tokyo.ac.jp/about-the-laboratory/smmil-e) and BioMEMS group of **IEMN**. The thesis will be supervised by Dr. M. Cagatay Tarhan and Prof. Fabrizio Cleri. Interested candidates should contact M. C. Tarhan at: **cagatay.tarhan@isen-lille.fr** and **cagatay.tarhan@yncrea.fr**.

Project description

Many biological processes related to cells are influenced by changes in cell shape and structural integrity. Therefore, the mechanical properties of cells can potentially be used to reflect the state of their health. This connection between the biomechanics and diseases has been attracting scientific research attention, especially for cancer research where diseased cells proliferate uncontrollably and disrupt the organization of tissue. Recent cancer research showed a great potential for biomechanical cell properties to be used for a greater understanding of malignant transformation. Invasive cancer cell lines exhibit biomechanical properties that are distinct from their noninvasive counterparts. A reduction in stiffness with increasing metastatic potential in human cancer cell lines has been reported in several studies. Therefore, studying the biomechanical and electrical properties of the cancer cells is of great importance in developing diagnostic tools or therapeutic actions. This project aims at developing a high-throughput technique to obtain the biophysical signature of cancer cells and to distinguish their sub-populations in a suspension. In practice, this target leads to identify CTCs and distinguish different populations among cancer cells in a time, cost and labour effective way to use them for routine clinical use.

Objectives

The PhD student will first work on designing and fabricating a microelectromechanical systems (MEMS) device with an integrated microfluidic channel to perform measurements on single cells. This device will be characterizing each cell mechanically and electrically. Several target indicators, e.g. size, stiffness, viscous losses, membrane capacitance, cytoplasm resistivity and shape recovery time, will be tested for identifying cells with different properties. At first, different breast cancer cell lines will be distinguished based on their biophysical properties, which will be followed by leukemia and immune cells. The student will be building the setup, performing experiments for cell characterization, applying statistical analysis methods to find the best indicator(s), and optimize the device, setup and protocols to develop an effective biophysical signature of cells according to their metastatic potential. The final goal will be performing measurements on pre-filtered blood samples.

PhD candidate

A highly motivated candidate, willing to perform the described interdisciplinary research, will be welcome in the team. Candidates should hold a Master's degree (or equivalent). Candidates with some experience in microtechnologies, such as MEMS and/or microfluidics, are preferred and experience in biology is appreciated. The research will be conducted in English.