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PhD Topics from Sept/Oct 2017

Title: **Microsystem to analyze and isolate small population of Leukemia cells with physical phenotype**

Acute myeloid leukemia is a highly heterogeneous disease. Our consortium already demonstrated that persistent leukemia cells are few, sometimes less than few hundreds. These cells are (i) the causative agents of late relapse, (ii) refractory to treatments and (iii) leading to relapsing patients poor survival. Deep sequencing by NGS allows identification of these residual cells but their detection is still technically challenging due to lack of phenotypic markers. There is a critical need to find new ways to detect and purify them to anticipate relapse.

This PhD subject aims to analyze and isolate small subpopulation of leukemic cells through their biomechanical properties using MEMS and microfluidic technologies.

The project will start by performing cell characterization (size, mechanical stiffness, deformability, shape recovery time) to determine a high content physical phenotype of relevant cell types. Measurements will be performed with our MEMS tweezers-based platform. The platform will be improved to reach high throughput cell analysis (up to 100 cell/hour) and determine statistically relevant parameters for discriminating leukemia blasts in a heterogeneous cell population.

In the second phase, a microfluidic device will be designed and processed to identify (count) the blast cells in a cell culture sample. The microfluidic device will stimulate the biomechanical response of a cell by squeezing it in a microchannel. The cell size, deformability or recovery time will be measured by recording electric signals on integrated electrodes in contact with fluid as impedance of a flowing cell alters the measured fluid conductivity. The microfluidic device will be evaluated by detecting and counting blast cells from prepared solutions before using it on actual samples. Evaluations will be carried out with an in-house mouse model of tumor dormancy using the fluorescent-protein-tagged cell lines with the objective of technology/protocol transfer to the clinics.

The PhD will be conducted in Lille hospital-University campus in the SMMiL-E collaboration with the University of Tokyo. The biological and clinical expertise is provided by the INSERM team of T. Idziorek and B. Quesnel on persistence of Leukemia cells. Due to the international teams hosting this PhD, all communications will be done in English.

- Keywords: MEMS technology, cell biomechanics, Leukemia, biophysical phenotyping and cytometry.
- PhD applicant skill: Microsystems, electrical engineering, experiment, cell biology
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