M2 Internship offer:

Understanding Red Blood Cell adhesion on microfabricated devices for health detection

Scientific context:
Integrated micro devices for bioanalytics (*e.g.*, lab on a chip, biosensors…) require the integration of several functions which can only be made after several micro-technological fabrication steps. Such devices can be used, *e.g.*, for cell actuation via optical tweezers or cell detection via photonic devices, and they can be integrated in microfluidic circuits. Their fabrication is performed through several steps of material deposition, lithography, plasma etching…
We have found that these fabrication steps lead to a modification of the surface properties of materials, in particular silica, despite extensive cleaning steps. These modifications seem to trigger Red Blood Cell (RBC) non-specific adhesion, which may jeopardize the proper operation of the device.

Objectives of the internship:
The objective of the proposed internship is to understand the physico-chemical modifications occurring during the microfabrication process and leading to RBC adhesion. The longer-term goal is to control the surface properties of microfabricated devices to obtain anti-adhesive surfaces for the cells.
To this aim, the recruited student will characterize the surface of unprocessed and processed silica. This means that she/he will be trained in microfabrication (Nanolyon facilities) and in surface characterization technics (X ray photoelectron spectroscopy, water contact angle measurement, atomic force microscopy, streaming current). He/she will also study protein and human RBC adsorption (L2 Lab at INL).
Therefore, the proposed internship is at the crossroads of biology, physics, chemistry and engineering.

Scientific impact and applications:
Controlling cell adhesion after microfabrication has applications in several fields, in particular biosensing, lab-on-a chip, microfluidics, cell biomechanics with microfabricated optical nano-tweezers… The microfabricated devices can be used for biomedical applications such as infectious diseases monitoring (malaria), cancer prognosis and drug screening assays.

Integration @INL:
The proposed internship is part of a larger project “CellDance” funded by the French ANR. At INL, the project involves members of the Devices for Health and Environment team and members of i-Lum team.
The “Devices for Health and Environment” team focuses on the design and fabrication of microsystems and sensors for healthcare and environmental monitoring. To carry out this research, they have developed expertise in instrumentation, microfabrication, surface physico-chemistry, biophysics, physiology and microfluidics. The i-Lum team aims at developing optical devices based on original concepts in photonic engineering, for a wide range of applications including optical sensing for health and the environment. To this aim, they develop cell detection and actuation devices for medical diagnosis and environmental analysis.

Training period:
The expected training period (4-6 month) will be from February/March to July/August 2024.

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