INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	Hydrodynamics Laboratory (LadHyX)
Website of the Host Laboratory	https://www.ladhyx.polytechnique.fr/en/
Research Group	Vascular bioengineering and mechanobiology
Internship Supervisor	Julien Husson (https://cellmechanics.jimdofree.com/)
Internship Subject	Mechanical properties of neutrophils in acute inflammation
Student's level	☐ Advanced Undergraduate Students (3rd or 4th year) ☒ Master's students (1st or 2nd year) ☒ PhD students
Proposed Duration	☐ 3 months ☐ 4 months ☒ 5 months ☒ 6 months
Prerequisites	Basic knowledge in mechanics, taste for interdisciplinary experimental work at interface with cell biology
Internship description (max. 15 lines)	The Covid-19 disease mainly affects the lungs. The immune response of many patients gets out of control and massive liberation of inflammatory cytokines ("cytokine storm") induces severe damage to the lung. Many Covid-19 patients in intensive care suffer from hyper-inflammation and develop acute respiratory distress syndrome (ARDS). One of the characteristics of ARDS is a massive influx of a particular type of white blood cell, neutrophils, into the lungs, where they get trapped. One important cause of this trapping is that neutrophils become stiffer due to both confinement in small (~ 5 µm) capillaries and to the presence of cytokines in the blood. The mechanism of this leukocyte blocking is not well understood, including the respective role of confinement and cytokines in neutrophil stiffening. The objectives of this project are (i) to quantify the evolution of the mechanical properties of leukocytes when they are exposed to various cytokines and (ii) to determine whether these mechanical changes can be blocked by specific antibodies against the cytokine or its receptor. The mechanical properties will be determined with a micropipette-based microindentation device on single cells under a microscope, developed in the hosting lab. This project is a collaborative work with the group of Oliver Nüsse (Université Paris-Saclay, Institut de Chimie Physique, Orsay). The student will be trained in single cell mechanics as well as basic cell biology.

The boxes marked with cross implies eligible