Master 2/3rd year engineering school
Imaging/microfluidics or engineering internship

Supervisors:
Frank Hyvrier, frank.hyvrier@agrosupdijon.fr
J.-M. Perrier-Cornet jeanmarie.perrier-cornet@agrosupdijon.fr
Pascale Winckler pascale.winckler@agrosupdijon.fr
P.-Y. Louis pierre-yves.louis@agrosupdijon.fr
PAM laboratory, PMB team, Institut Agro Dijon - Université de Bourgogne
Bâtiment Epicure, Aile Nord, 3rd floor, 1 esplanade Erasme, 21000 Dijon

Development and optimisation of concentration gradient microfluidic chips for the analysis of cellular responses to osmotic stress

(IAforStressLife project)

The research unit Procédés Alimentaires et Microbiologiques brings together three complementary teams (Physico-Chemistry, Microbiology, Process Engineering) to carry out **multidisciplinary research into food and wine**. The internship will take place in the PMB group: **Microbiological and Biotechnological Processes team**. The UMR's research focuses on understanding the physical, chemical and biological phenomena that determine the quality of food and wine. The knowledge gained from this work is used to improve product quality (nutrition, safety, sensoriality, practicality, etc.) and the efficiency of food processes. The research carried out covers the societal fields of food, health, well-being and the environment.

This work is based on the equipment and technical expertise of the DImaCell platform (www.dimacell.fr), with the collaboration of the ICB laboratory's Nanofabrication Centre (https://icb.u-bourgogne.fr/centre-de-nanofabrication-cnf/) for the manufacture of microfluidic chips.

Scientific context:

Following an environmental perturbation generating osmotic stress, a microorganism responds both passively, by adapting its permeability and volume, and actively, by synthesising solutes that regulate water activity. This response depends on the amplitude and rate of variation of the water disturbance. This disturbance can lead to irreversible damage and permanent inactivation of these cells. Understanding and controlling dehydration/disturbance mechanisms is crucial for the biotechnology and pharmaceutical industries.
Under experimental conditions, these conditions and the reactions of the microorganisms can be controlled using a microfluidic device. Set up in the laboratory, this device incorporates microfluidic chips installed in a microscope, enabling trapped cells to be subjected to different concentrations of solute at a given time. These chips, which are still in the prototype stage, are used to monitor and acquire images of model microorganisms (non-saccharomyces oenological yeasts sensitive to dehydration) subjected to controlled osmotic stress. All the data obtained will be used as part of the "IAforStressLife" project to develop an artificial intelligence capable of controlling and optimising the disturbance according to cell type.

Tasks entrusted to the student

The research work consists of
(1) studying the fluidic properties of these prototypes within a theoretical and experimental framework,
(2) designing and implementing experimental protocols to assess their effectiveness in responding

to the problem posed,
(3) propose corrections and identify areas for improvement on the chips,
(4) study the applications of this technology outside the scope of the project.

This subject requires basic experience in microfluidics as well as knowledge of transmission and epifluorescence microscopy. An interest in microbiology, image analysis, artificial intelligence and cutting-edge technologies would be appreciated.

Date and duration of internship :
- Start date: February/March 2024
- Duration: 6 months

Contact
For any questions or additional information, please contact
Frank HYVRIER. Applications (CV + covering letter) should be sent to the following address: frank.hyvrier@agrosupdijon.fr with "IAforStressLife Project" in the subject line.