**Bacteria-trapping microfluidics for spectroscopic analysis of bacteria-gold nanoparticles complexes**

Responsible Scientific Assistant: Marwan El Chazli (marwan.elchazli@epfl.ch)
Professor: Christophe Galland (chris.galland@epfl.ch)
Project type: Masters project

## Context

Bacterial contamination of food products represents an ongoing public health hazard, results in a massive waste of food and costs hundreds of millions of francs to food companies every year.

At the heart of it is the fact that current bacterial detection and identification methods used in the food industry (and many other industries) are slow and can require up to a week to provide results.

At the Laboratory of Quantum and Nano-Optics (LQNO), we are looking to build the next generation of bacterial sensing technology, using Raman spectroscopy and its variants, combined with a solid understanding of biochemistry, microfluidics know-how and powerful machine learning techniques.

The project is extremely interdisciplinary and gives students the opportunity to familiarize themselves with a wide range of technologies, as well as gain experience in translating basic sciences to applied research.

## Project overview

The working principle of our method is illustrated in Figure 1. In order to detect and identify bacterial cells, they need to be concentrated and immobilized in a specific spot in a microfluidic chip which is compatible with optical spectroscopy (i.e., transparent at specific wavelengths). Several different potential designs to achieve this have been identified and prototyped: the student will be tasked with reviewing and developing some of those designs and will have the opportunity to propose new innovations and ideas for bacteria trapping. Manufacturing will be done in the CMi cleanrooms.

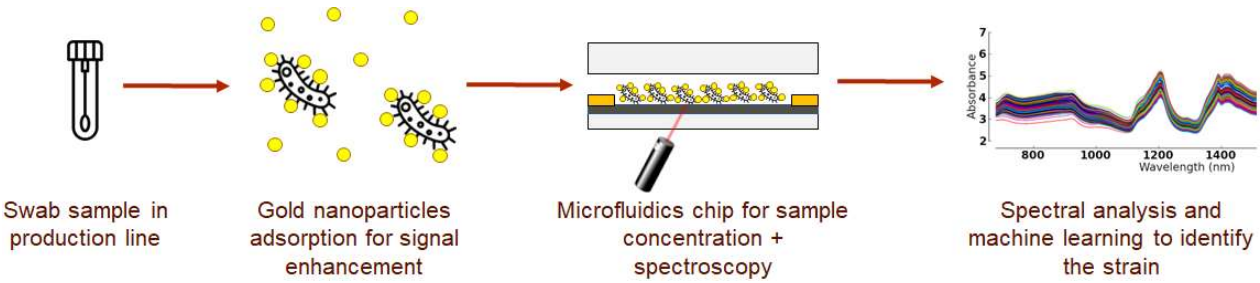


*Figure 1. Current process flow: a liquid sample containing bacteria is enriched with gold nanoparticles and immobilized in a microfluidic chip. Then, the spectral signature of the bacteria-gold complexes is acquired and analysed with machine learning to identify the strain of bacteria.*

## What the student will do

Throughout the project, the student will design and prototype microfluidics chips using the cleanroom facilities of CMi and learn about a wide variety of technologies, including photolithography, sputtering, scanning electron microscopy, and many others. In addition, the student will have the opportunity to work with other team members to integrate their prototype and test it with real bacteria samples. Depending on the progress of the project, opportunities for publication or patenting might arise, which the student will be encouraged to participate in if they wish.

**Who we are looking for**

We are looking for students pursuing a degree in microengineering or related fields. Students from unrelated fields may also apply if they demonstrate prior experience or great interest and willingness to learn. Most importantly, we are looking for students who are motivated and able to work autonomously.

**Interested? Get in touch to apply or learn more ->** marwan.elchazli@epfl.ch