

Microfluidics for cell analyses

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Expected number of students: 3 – 5 students

Category: In-house

Project description

Microfluidics is a relatively new technology emerged in the past two decades. This technology focuses on the technical approaches handling fluidics samples and phenomena in the micro-meter (10^{-6} m) scale. The foreseeable significant applications of microfluidics opened doors in a wide range of biomedical applications (*e.g.* bio-sample analysis and drug delivery). Fluidigm Co., Advanced Microlabs LLC and Advanced Liquid Logic Inc. are examples of recently established international microfluidics-based companies. Clearly, microfluidics has been creating tremendous potentials in the future market worldwide.

Here we have planned to apply microfluidics to perform cell-related analysis. We will teach you on how to design and fabricate microfluidic devices; and you will have hands-on experience throughout the project. We will also teach you on how to culture cells and apply both convention and microfluidics-related cell analysis techniques for this project (such as **Fig. 2** and **Fig. 3** as shown below). We will introduce you to utilize a well-developed software package to automate and optimize the microfluidic operations (*e.g.* liquid manipulation) and further the cell analyses using our existing microscope system as shown in Fig. 1. While the hardware instrumentation and skill sets will be provided by the supervisor, the selected students will need to develop a function set to achieve particular microfluidic goals, such as (1) liquid delivery within microfluidic devices, (2) long-term cell culture in microfluidics, and (3) post-processing and quantification of the cells growing under different microenvironments. The integrative knowledge of various engineering aspects involved in this project can upgrade the student's insights to general engineering problems.

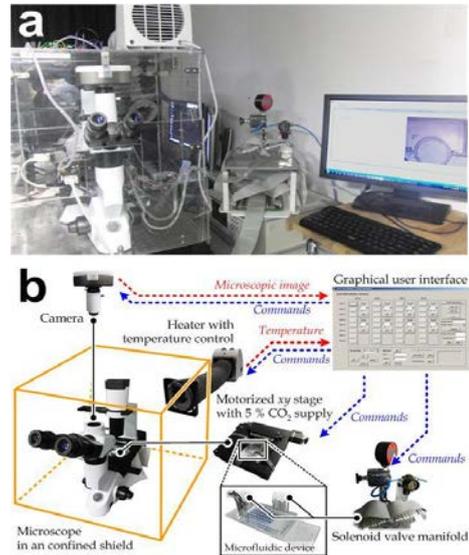


Figure 1. (a) Photograph and (b) schematics of the automated microscope system.

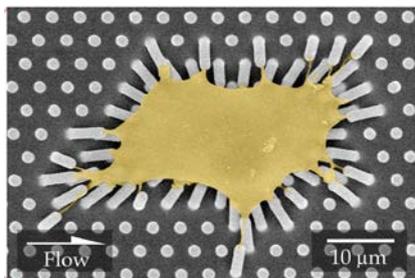


Figure 2. Cell traction on a micropost array.

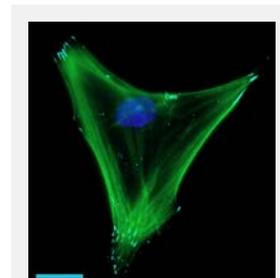


Figure 3. A cell stained with focal adhesions, nucleus and actin.

Students are welcome to contact the supervisor for details of the project.