

# High-performance Lab-on-a-Chip for biomechanics research

Master project theme

## Introduction

Lab-on-chip (LoC) is a technology that enables biological research on small sample volume, high throughput platforms. There are many aspects in the development of the technology, one of them is to integrate mechanical actuations. In our group we have developed a multi-well platform that enables heart-on-chip research. This platform has robust control over the deformation of the samples through pressure control underneath a thin film.

## Theme

There are several important aspects in the further development of the platform. Below is a short list of potential projects that *each* will have significant impact on performance and functionalities:

- on-demand, multi-mode actuation for applying various types of stress/strain on biological samples;
- Miniaturization and massive parallelization of the system for high-throughput screening;
- Integration of microfluidic flow control for studying shear stress effect on samples as well as providing long term culturing;
- Cell morphology monitoring for better understanding of long term strain effect on samples, which requires imaging system integration.

The students are also encouraged to come up with their own creative ideas in the scope of the theme. These projects nest under a collaboration between Microsystems group, BME and UMC Utrecht. You will work with experts in different fields that are involved in this interdisciplinary research.



Figure 1: 'heart on chip' platform. A PDMS film is at the bottom of each well, performing sinusoidal up and down movement. Cylinders for pneumatic actuation can be seen underneath the chip.



Figure 2: high-throughput system with 144 wells.

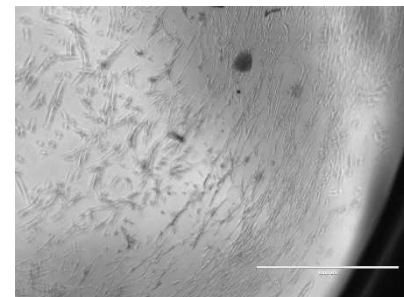


Figure 3: Fibroblasts showing strain avoidance in the radial direction of the well.