Exjobb / Master Thesis work or project

Manufacture and testing of a microfluidic cell sorter, using real-time image classification and machine learning

Your Background

You enjoy experimental work

You are familiar with programming

You are creative in your work

You have an engineering mindset

We encourage two students to collaborate on this project, but one student is possible.

Equipment available

Microscope with camera available. A suitable 3D printer can be used. Pumps need be specified and purchased.

Contact information

T cell computational biology group

Dept. molecular biology

Johan Henriksson

Phone: 090-786 6336

johan.henriksson@umu.se

www.henlab.org

Collaboration with:

BioPhysics & BioPhotonics group

Magnus Andersson

magnus.andersson@umu.se

Department of Physics

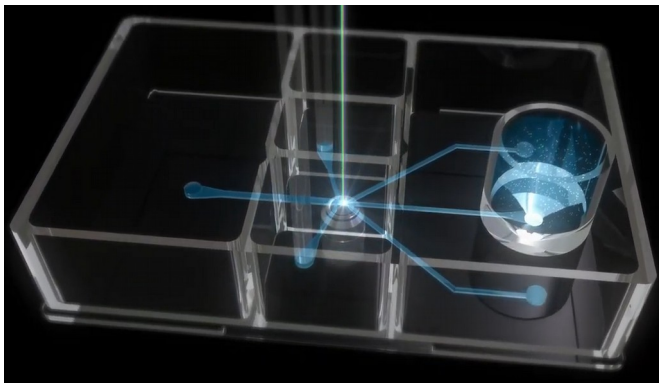

Figure 1. Commercial laser-based microfluidic cell sorter

Project Goals

1. Design a microfludic device for sorting cells/nuclei from debris.
2. Manufacture the device and connect to pumps and the microscope.
3. Evaluate the sorting capacity by manual control of the device.
4. Collect images and train a neural network to identify cells.
5. Connect the algorithm with control of the pumps to achieve automatic sorting.

Background

Modern biology relies on the analysis of individual cells at high-throughput. Especially microfluidic devices are now employed to scale up the analysis to millions of cells. We have for example established a single-cell center for RNA sequencing. While we have commercial microfludic equipment for the latter, the preparation of cells remains a challenge. Currently we struggle with sorting cells from debris in a manner that doesn't kill some types of cells.

We wish to design a microfluidic cell sorter to prepare high-quality material. A commercial sorter exist (Fig 1) using a laser to identify useful cells. However, we think we can use a camera combined with modern machine learning to identify useful cells in a much cheaper manner - also capable of a more complex readout.

To produce the device (suggested design, Fig 2), we suggest a 3D-printer based method developed in the group of Magnus Andersson, T.Dahlber (2018) Scientific reports - http://umu.diva-portal.org/smash/get/diva2:1181373/FULLTEXT01.pdf

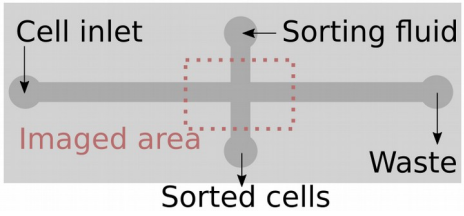

Figure 2. Possible design for a microfludic sorter that can be mounted on a regular microscope. The device can be 3D-printed.