Master Thesis Project:
Single-Molecule DNA Mapping in Nanofluidic Channels

Background:
Methods to sequence whole genomes have increased in speed and decreased in cost tremendously during the last decade and the long-term goal of sequencing a whole human genome for $1000 is approaching fast. The large problem with the third generation sequencing methods is that the read lengths are very short and therefore each base has to be read up to 100 times to allow for the large "puzzle" to be completed.

Optical methods to obtain large-scale maps of the genome that can act as "frames" when completing the puzzle could therefore potentially reduce both the time and the cost to complete the sequencing processes. Optical mapping of DNA might also be of relevance for rapid identification of bacteria and viruses.

One way to obtain a DNA "barcode" is to confine fluorescently labeled DNA into a nanofluidic channel and gently heat the DNA. The dye that labels the DNA will dissociate from the parts of the DNA that melt and a pattern will be obtained that corresponds to the underlying sequence.

Project:
The project is devoted to developing new ways to obtain such barcodes on DNA confined in nanofluidic channels, where a heating device does not need to be used. We also wish to use the developed methods for identification and characterization of different kinds of bacteria. Rapid methods that can identify specific bacteria, preferably on the single bacteria level are of great interest in disease treatment.

We use fluorescence microscopy and nanofluidic channels to obtain pictures of nanoconfined DNA. In the later stages of the project we will potentially work with handling cells and/or bacteria for DNA extraction.

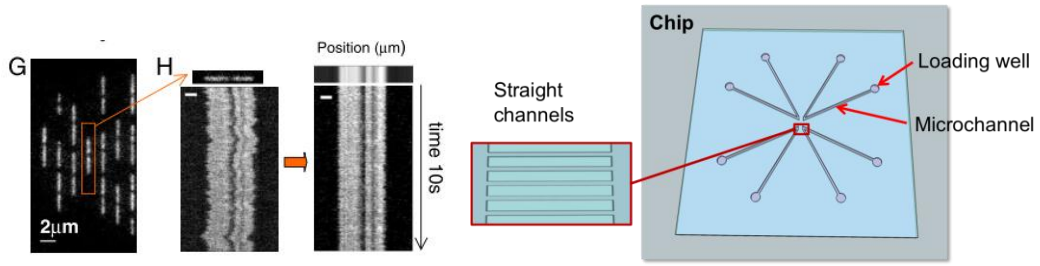

Figure: Left: *λ-DNA molecules heated to a temperature were they are partially melted, they all show a distinct barcode pattern. Obtained from Reisner et al, PNAS 2010. Right: A schematic of the nanofluidic chip.*

Person:
We are looking for highly motivated student with an interest in interdisciplinary research on the borders of biophysics and nanotechnology. The project can be either 30 or 60 credits.

Contact:
If you are interested in the project or have any further questions please contact:
Fredrik Westerlund, Assistant Professor
Chemical and Biological Engineering, Chalmers University of Technology
fredrik.westerlund@chalmers.se, Tel: 031-772 3049