

Brain-on-a-Chip: Novel Designs and Fabrication Methods

Master Thesis Project (6 months or 1 year)

Herland Lab, Department of Micro- and Nanosystems, KTH Stockholm

Supervisor: Dr. Thomas E. Winkler (winklert@kth.se)

Organ-on-a-Chip systems bring together recent advances in microsystems technology and biology to create well-controlled models of human organ structures. Such models are critical to gain better insight into biological functions and thus aid in developing new therapies. This is especially true for the nervous system, one of the most complex and least well understood organs.

Brain-on-a-Chip systems integrate microfluidics and stem cell engineering to create an artificial neurovascular unit with equivalents of blood vessels, the blood-brain-barrier, and gray matter in a small device that can also feature sensors to allow for real-time monitoring. To date, fabrication of these systems mostly relies on traditional microfabrication approaches such as photo- and soft lithography.

The goal of this project is to explore non-traditional fabrication methods that may enable novel designs of Brain-on-a-Chip systems, allowing for *e.g.* more robust device fabrication, more readily integrated sensing functionalities, or more biologically relevant geometries. Specific approaches include 3D-printing, sacrificial molds, and tape microfluidics.

You will:

- Learn about current challenges in Brain-on-a-Chip systems
- Design new prototype systems using CAD software
- Fabricate designs, which may involve 3D printing, micromolding, laser cutting, photopatterning...
- Characterize devices for physical properties and biological compatibility, which may involve fluorescence microscopy, electrochemistry, cell culture, *etc.*

You should:

- Be highly motivated and creative, able to work independently, and open to critical feedback
- Have a relevant educational background, *e.g.* in electrical or biomedical engineering
- Appreciated but not required: Have prior practical experience in device fabrication or of working in an engineering/biological research environment

How to apply: Please send your CV (including reference contacts), academic transcript, and a personal letter (all in English) to Thomas Winkler (winklert@kth.se).

