Master thesis project:

‘Development of an analytical image pipeline for quantitative phase imaging’

Background

Quantitative phase imaging (QPI) is an ideal method to non-invasively study the optical phase delay (or phase retardation) of samples, such as live cells. As the optical phase delay of a live cell changes during its physiological state, it can be used to derive important information on its health, morphology and also to calculate related physical properties like cellular dry-mass. This makes QPI an attractive imaging modality to monitor the effect of drugs and pharmaceuticals in a range of biological systems, including mammalian cells and bacteria. In this project the student will adopt existing analytical pipelines to extract the cellular dry-mass of bacterial cells used in toxicological experiments involving QPI and microfluidic technologies. The project is focused on the pre- and post-processing of available image materials but has room for contribution to experimental work with a high-throughput automated microscopy platform. The resulting analytical tools and data will directly contribute to our understanding of toxicological effects on bacterial cells and be foundational for a novel toxicological screening platform.

Master-thesis project description and aims

In this master thesis, you will develop an analytical pipeline to process existing QPI images. Your tasks will involve, (i) converting existing QPI images into a readable format, (ii) aligning images, (iii) segmentation and detection of bacterial cells and (iv) the mathematical processing necessary to derive from QPI images the dry-mass of individual cells. If time permits, you will also be involved in performing exposure experiments in microfluidic devices in conjunction with automated microscopy.

Methods

In this project, you will learn the following methods:

- Quantitative phase imaging and dry-mass calculations
- If time permits: high-throughput automated microscopy

You should be a master-level student with a background in image processing and programming (Matlab, Python).

Students from all walks of life and backgrounds are welcome to apply!

Have a look at what else we are up to: https://behrendtlab.com/

Interested? Please contact Lars Behrendt, lars.behrendt@scilifelab.uu.se or petter.ranefall@it.uu.se. The scope of the project is a 30-45 hp master thesis.