HANDS-ON TRAINING COURSE FOR BEGINNERS IN CONFOCAL MICROSCOPY III

May 12-14, 2025

Biomedicum, Ravila 19, Tartu, ESTONIA

(Introduction to Confocal Microscopy MVBS.02.002, 2 ECTS)

This 3-day course, followed by a two-week hands-on individual training phase, is designed to provide a basic understanding of confocal imaging principles and introduce the confocal microscopes available at the core facility. The program combines theoretical lectures, image analysis training, and hands-on experiments, with a particular focus on live-cell imaging.

The training is free of charge and open to PhD students and research staff from the University of Tartu, as well as other research institutions in Estonia, Latvia, and Lithuania. Applicants should have a basic knowledge of microscopy and its applications.

Additional lectures are available online in Moodle and will be open to registered attendees.

PROGRAM

Monday, May 12 ***11.00-17.00*** ***1st floor, room 1024***

Theoretical session: Introduction to basics of the confocal microscopy

HEITI PAVES, PhD (Optika & Diagnostika, Zeiss)

- **Principles of light microscopy.** Anatomy of confocal microscopes: light sources, cameras, sensors and objectives.

- **Zeiss LSM 780 and Zeiss LSM 980 microscopes.** Advanced techniques in fluorescence confocal microscopy: Airyscan technology for super-resolution imaging.

ALLEN KAASIK, PhD (University of Tartu)

- **Practicalities of confocal imaging**. How to choose fluorophores. Genetically encoded fluorescent proteins and biosensors. From noise to photobleaching.

ANNIKA VAARMANN, PhD (University of Tartu)

- **High-resolution imaging with advanced software tools.** Introduction to spinning disc Operetta CLS High-Content Analysis System and Harmony analysis software

MIRIAM HICKEY, PhD (University of Tartu)

- Image analysis in Biosciences. Automated and semi-automated image analysis for biosciences (Imagej, QuPath).

Tuesday, May 13 ***09.30-12.30*** ***3rd floor, room 3011***

Practical session 1: Live-cell imaging

ANNIKA VAARMANN, PhD

Live-cell imaging. Multicolor sequential and simultaneous imaging techniques. Single fluorescent proteins versus ratiometric probes. Time-lapse imaging.

Hands-on activities for participants:

Imaging of intracellular signaling using specific fluorescence (i.e., Perceval HR for ATP/ADP measurements) sensors. Imaging of Ca^{2+} transients in cytosol, endoplasmic reticulum and mitochondria.

Tuesday, May 13 ***13.30-17.00***

Practical session 2: Organelle imaging

TBA

Principles of co-localization studies. Markers for studying the intracellular organelles (lysosome, autophagosome and mitochondria) dynamics.

Hands-on activities for participants:

Imaging of autophagy, mitophagy and ER-phagy markers.

Wednesday, May 14 ***09.30-12.30*** ***4th floor, room 4004***

Practical session 3: High-throughput imaging

ANNIKA VAARMANN, PhD

A brief, hands-on introduction to working with the Operetta system, including practical instructions on system operation, key technical considerations, image acquisition, and software usage.

Thursday, May 15 - 28

Hands on individual training phase. All preregistered participants could joing the core facility staff in their experiments or bring in their own samples free of charge.

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