UNIVERSITY OF GOTHENBURG

CORE FACILITIES

SC00004 Cellular Imaging, 3 credits

Cellulär avbildning, 3 högskolepoäng

Third-cycle level / Forskarnivå

Confirmation

This syllabus was confirmed by the Council for PhD Education at Sahlgrenska Academy on 2019-01-29, and was last revised on 2021-09-23. The revised course syllabus is valid from Spring semester 2021.

Responsible Department
Core Facilities, Sahlgrenska Academy

Entry requirements

To qualify for admission to the course, the student has to be registered as a doctoral student (third cycle) at Sahlgrenska Academy or at another faculty or university.

Learning outcomes

The course aim will be to provide students with a solid understanding of current light and electron microscopy technologies and methods. They will identify the potential applications for each instrument type and will gain technical experience of more advanced techniques associated with these technologies.

Knowledge and understanding

After completing the course, the student is expected to be able to:

- Have an overview of several basic and advanced fluorescence microscopy techniques biomedical sciences/research.
- Have an overview of several basic and advanced electron microscopy techniques in biomedical sciences/research
- Describe the basics of the technology behind widefield and confocal microscopy, and the most common applications of these technologies in life sciences.
- Describe the basics of the technology behind the transmission and scanning electron microscopy, and the most common applications of these technologies in life sciences.

- Explain the principles of single-photon confocal scanning microscopes (CSM) and why such microscopes are specially adapted to image 3D samples with high optical sectioning capacity
- Explain the principles of multiphoton excitation scanning microscopes, and describe their advantages and drawbacks as compared with CSMs.
- Explain the principles of super-resolution microscopy (single molecule localization and structured illumination), and describe their advantages and drawbacks as compared with CSMs.
- Explain the principles of cellular 3D volume electron microscopy and why such microscopes are specially adapted to image 3D volume

Competence and skills

After completing the course, the student is expected to be able to:

- Set up imaging equipment for various applications and understand the limitations of each technology.
- Explain the advantages and limitations of each imaging technology and applications and be able to select which instrument type is best suited for specific sample types.
- Describe newly emerging technologies and how they relate to current life sciences approaches

Judgement and approach

After completing the course, the student is expected to be able to:

- Set up and use a modern microscope typically found at the biolabs today: conventional, fuorescence microscopes, laser scanning confocal and electron microscopes (SEM and TEM).
- Plan, perform, present and criticize research projects using one of the microscopy techniques available at the Centre for Cellular Imaging

Course content

The course will deal with different aspects of modern basic and advanced cellular and molecular imaging.

This course provides:

- Basic concepts in modern fluorescence microscopy: What is fluorescence, different fluorochromes, excitation methods, emission characteristics, purpose and uses
- Basic concepts in modern transmission and scanning electron microscopy.
- How to prepare cells/tissues for light and electron microscopy.
- Advanced laser systems: Laser Scanning confocal microscope: Fundamentals of confocal microscopy, advantages in comparison to fluorescence microscopy, different approaches and instrumentation limitations. Will include line scanning microscopy, spinning disk microscopy, multicolour, Z-stacks, user tips.
- Functional microscopy: FRET, FRAP, FCS, FCCS, etc.
- Advanced techniques in electron microscopy: Correlative light and electron microscopy

(CLEM), 3D electron-tomography; 3D array-tomography; High pressure freezing and freeze substitution; Tokuyasu method, etc.
- Application of advanced microscopy methods for current research topics
- Multiphoton confocal microscopy
- Super-resolution microscopy: single molecule localization and structured illumination
- Laser capture microdissection for non-contact sample handling
- High content screening fluorescence microscopy for system biology

Types of instruction

Handouts of the lectures and selected scientific articles will be distributed during the course.

Language of instruction
The course is given in English.

Grades

The grade Pass (G) or Fail (U) is given in this course.

Types of assessment

The examination of the course will be a written report from each student, and an indi-vidual practical examination on the microscopy equipment that the students have to choose during the course. In addition, to pass the course the student has to attend a minimum of 80% of the lectures and demonstrations.

If a PhD student, who has been failed on the same examining course component twice, requests a change of examiner before the next examination session, a request of this kind should be sent in writing to the department responsible for the course, and granted, unless there are special reasons to the contrary (Chapter 6, Section 22, Higher Education Ordinance).

If a PhD student, who has been failed on the same examining course component twice, requests a change of examiner before the next examination session, a request of this kind should be sent in writing to the department responsible for the course, and granted, unless there are special reasons to the contrary (Chapter 6, Section 22, Higher Education Ordinance).

Course evaluation

The course evaluation will be provided both as a written questionnaire (joint for Sahlgrenska Academy) and orally as a discussion between the students and the course leader. The course responsible teacher compiles analysis of the course evaluation and makes suggestions for further development of the course. The result and any changes in the set-up of the course shall be communicated both to the students that carried out the evaluation and to the students who are about to start the course.