MICRO-562

Experimental biomicroscopy

Altug Hatice, Seitz Arne

Cursus	Sem.	Type
Biomedical technologies minor	E	Opt.
Computational and Quantitative Biology		Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Minor in Imaging	E	Opt.
Neuro-X minor	E	Opt.
Neuro-X	MA2, MA4	Opt.
Photonics minor	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	1 weekly
Exercises	1 weekly
Project	2 weekly
Number of positions	

Summary

By combining hands-on and theoretical training, this course introduces commonly used optical microscopy techniques. The lab training takes place in BIOP Core Facility and provides access to use microscopes and image biological samples. Theoretical part covers their basic operation principles.

Content

If you want to use optical microscopes and understand the principles behind their operation for generating/processing optical images with different samples (biological and beyond), then this course is for you!
The course combines theory with hands-on laboratory experience to introduce most commonly used optical microscopy techniques in biomedical research including bright-field, dark-field, phase-contrast, DIC, polarization, and various modern fluorescence microscopy methods such as FRET, TIRF, FRAP, FLIM. In addition, the course introduces several advanced fluorescence imaging techniques such as confocal, multi-photon, and super-resolution microscopy e.g. STED, PALM, STORM.The experimental part takes place at EPFL's state-of-the-art Bioimaging and Optics Core Facility and provides unique opportunity to the students to access optical microscopes and teaches practical aspects with optical alignment, sample handling, data acquisition, image analysis.

Keywords

Modern optical microscopes, hands-on laboratory experience, optical alignments, contrast-enhancing imaging techniques, fluorescence microscopy, confocal microscopy, high quality optical images.

Learning Prerequisites

Recommended courses

Fundamentals of Microscopy, Selected topics in advanced optics (MT), modern optics (PHY) or General physics III/IV.

Important concepts to start the course

Basic knowledge in optics, wide field microscopy and fluorescence

Learning Outcomes

By the end of the course, the student must be able to:

- Choose an appropriate imaging method for investigating the biological sample of interest.

- Estimate the performance and limitations of optical microscopes.
- Sketch the essential elements of optical microscopes.
- Operate wide field and confocal microscopes.
- Assess / Evaluate the operation principles of commonly used microscopy methods
- Choose
- Choose an appropriate imaging method for investigating the biological sample of interest.

Transversal skills

- Use a work methodology appropriate to the task.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Communicate effectively with professionals from other disciplines.

Teaching methods

Lecturing with exercises (50%) and practice in EPFL's BIOP microscopy facility (50%).

Expected student activities

Following the lecturing and solving the exercises regularly is necessary for mastering the course contents. The solutions of the exercises are distributed at the next lecture. The student is invited to find his/her own solutions and to discuss them with the assistants. An active participation in the laboratory leads to the mastering of different microscopes.

Assessment methods

100% End-term exam, individual written exam

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Fundamentals of Light Microscopy and Electronic Imaging: Douglas B. Murphy, Michael W. Davidson (2012, 2nd edition)

Fundamentals of Photonics: Bahaa E. A. Saleh, Malvin Carl Teich (2018, 3rd edition).

Ressources en bibliothèque

- Find the references at the Library

Notes/Handbook

The course slides and exrcises are uploaded on Moodle

Moodle Link

- https://go.epfl.ch/MICRO-562