Module title			Abbreviation
Optical methods for visualization and manipulation of neural circuits- from synapses to behavior			03-TNOM-191-m01
Module coordinator		**Module offered by**	
Institute of Clinical Neurobiology		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Students will get a theoretical introduction in light microcopy methods in neurobiology and systems neuroscience. Main topics are: Physics of light, building of a standard microscope, objectives, numeric aperture, bright field, phase contrast, fluorescence microscopy, confocal microscopy, resolution, contrast, Airy disc patterns, fluorescent molecules and dyes, image processing, preparation of images for publication, Software: GIMP and Fiji (ImageJ), imaging of calcium ions, genetically encoded calcium indicators (GCamp), viral techniques, lentiviral vectors, MMLV-based vectors, AAV, rabies virus, new developments in image analysis, deep learning, principles of circuit neuroscience, optogenetics, video-based behavioral analysis.

Intended learning outcomes

Students who successfully completed this module will have acquired distinct knowledge about light & fluorescence microscopy, in vivo calcium imaging and optogenetic methods in neuroscientific research. Processes of image acquisition, image preparation and image analysis will be introduced. Thus, students will be able to better understand, design and evaluate experiments based on microscopy and modern optical methods in the neurosciences. In short lab visits, the students will learn about principle components of microscopes (e.g. epifluorescence, confocal). The students will learn how these components are used to get better microscopy data. The students will see how molecular tools (e.g. viral vectors) and modern methods (optogenetics, chemogenetics) are used to better understand the anatomy and function of neurons and neural networks. They will acquire the competence to better understand these kind of experiments, to analyse and evaluate them. They will also be able to evaluate methods of systems neuroscience and will be able to theoretically design representative technical approaches. Short student presentations (3 – 4 min) will mediate specific presentation competence with the aim to allow presentation of complex microscopy methods in a focused and understandable way for a heterogeneous expert audience. The overall aim is that students will be able to understand, question, evaluate, recapituale and present light microscopy approaches in neurobiology and system neuroscience.

Courses (type, number of weekly contact hours, language — if other than German)

S (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) Written Examination (30 to 60 minutes; also multiple choice) or
b) Protocol (10 to 30 pages) or
c) Oral examination of one candidate each (30 to 60 minutes) or
d) Oral Examination in groups of up to three students (30 to 60 minutes) or
e) Presentation (20 to 45 minutes)
Language of assessment: English

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Translational Neuroscience (2018) Supplementary course Translational Neuroscience (2018) Master's degree (1 major) Translational Neuroscience (2022) Supplementary course Translational Neuroscience (2022)