

4437	Cellular and Molecular Analyses of Brain Development			
	Zelluläre und molekulare Analyse der Gehirnentwicklung			
Responsible lecturer Prof. Dr. C. R. Rose (rose@hhu.de)				
Lecturers Kafitz, Dublin, Rose, Rütter, Dildrop, Gerhardt, Gottmann				
Module Organization Kafitz (kafitz@uni-duesseldorf.de)				
Workload 420 hrs	Credits 14 CP	Contact time 300 hrs	Self-study time 120 hrs	Duration 6 weeks
Type of lesson Lectures: 2 PPW Practical course: 18 PPW		Frequency: Annually		Intended group size 12 students
Learning outcomes/skills: The students are able to describe and apply the fundamental concepts and techniques of fluorescence-based immunohistochemistry. They can use these concepts for the identification of various cell types and brain structures and make judgments regarding physiological and development-related questions. Students can use advanced techniques in light and fluorescence microscopy and adequately develop and evaluate the resulting documentation. They can independently plan and carry out molecular biological techniques. They are able to work precisely and without supervision with measuring equipment and laboratory instruments.				
Contents Lecture: <i>Molecular analyses of brain development</i> The basics of light microscopy: optics and lenses, structure of a microscope, optical path, aberrations, types of microscopes. Basics of fluorescence microscopy and immunohistochemistry. Fluorochromes, illumination, artifacts. Cell-type-specific labeling of neural cells with diagnostic antibodies. Basics of patch-clamp recording. Brain development on the basis of selected brain regions (cortex, hippocampus, cerebellum). Maturation and function of neurons and glial cells in vertebrate brains. Molecular basics of brain development: induction of neuroectoderm, specification of brain regions, hedgehog signaling pathway, synapse formation Practical course: <i>Immunohistochemistry and molecular techniques</i> <i>Immunohistochemistry:</i> Primary and secondary immunofluorescence, identification of neural cell types, determination of the maturation stages of glial cells and neurons, marking of functionally relevant membrane structures in neurons and glial cells. <i>Fluorescence microscopy:</i> Components of a light microscope, epifluorescence microscopy, confocal laser microscopy, camera-assisted documentation, image processing. <i>Patch-clamp recording:</i> Electrophysiology of network activity during development in culture (demonstration on cortical mouse neurons). Preparation of mouse embryos at various stages of development; analysis of brain development using histology and whole-mount in situ hybridization; investigation of disturbances in brain development in various mouse mutations using histology, immunohistochemistry, western blotting and qRT PCR. Recommended reading, lecture notes: ○ Imaging in Neuroscience and Development: A Laboratory Manual. Cold Spring Harbor Laboratory Press ○ Development of the Nervous System. Sanes, Reh & Harris, Elsevier 2012. ○ Additional scripts and other documents will be available electronically through ILIAS.				
Entrance requirements Accepted for master programs in Biology, Biochemistry				
Assessment/Exams				

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| (1) Written examination about the contents of the lecture (70% of overall mark)
(2) Description of analyses by pictures and notes, performance of experiments and analyses (15%)
(3) Presentation: drafting of project, graphical description of project, presentation and discussion (15%) |
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Requirements for the allocation of credits

Regular attendance at classes and the practical course. Successful completion of a course project. Oral presentation in a seminar with an accompanying written handout.
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The final grade is calculated from the mark of the written exam (weigh 70% of final grade) and the description of analyses, performance of experiments and the presentation (weigh 30%).
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Relevant for following study programs/majors

Major Development and Physiology

Compatibility with study courses:
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Master Biology

Master Biology International

Master Biochemistry

Significance of the mark for the overall grade

According to the relevant regulations of each study program (Prüfungsordnung).
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Course language

English

14/05/16