

Module Number 3b	Title: Cellular and Molecular Analyses of Brain Development		
Module type: compulsory elective	Language: English	Group Size: 4 students	
Study semester: 1	Availability: winter semester	Duration: 1 semester	
Workload: 420 hrs	Credits: 14 CP	Contact time: 225 hrs	Independent Study: 195 hrs
1	Courses a) Lectures: 2 PPW b) Practical Course: 18 PPW		
2	Intended Learning Outcomes 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 judgements 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.		
3	<p>Content</p> <p>Lecture: Molecular analyses of brain development 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, artefacts. Cell-type-specific labeling of neural cells with diagnostic antibodies. 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</p> <p>Practical course: Immunohistochemistry and molecular techniques Immunohistochemistry: 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. Fluorescence microscopy: Components of a light microscope, epifluorescence microscopy, confocal laser microscopy, camera-assisted documentation, image processing. Patch-clamp recording: 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 hybridisation; investigation of disturbances in brain development in various mouse mutations using histology, immunohistochemistry, western blotting and qRT PCR.</p> <p>Recommended reading, lecture notes:</p> <ul style="list-style-type: none"> ○ Imaging in Neuroscience and Development: A Laboratory Manual. Cold Spring Harbor Laboratory Press ○ Development of the Nervous System. Sanes, Reh & Harris, Elsevier 2012. <p>Additional scripts and other documents will be available electronically through ILIAS.</p>		
4	Teaching methods Lecture and practical training with accompanying theoretical exercises.		
5	Prerequisites Formal: Successful completion of module 1; Proficiency in English level B2 of Common European Framework of Reference for Languages (CEFR)		

	With regards to content: Knowledge of cell biology, chemistry, physics, mathematics as well as basic knowledge of neurobiology required.
6	Examination types Cumulative examination: 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 analysis (15% of overall mark) 3. Presentation: drafting of project, graphical description of project, presentation and discussion (15% of overall mark)
7	Requirements for award of credit points Regular attendance at the practical course. Successful completion of a course project. Oral presentation in a seminar with an accompanying written hand out. 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%).
8	Module applicability (in other study courses) Master Biology Master Biochemistry Master Biology International
9	Assessment The mark given will contribute to the final grade in proper relation to its credits.
10	Module convenor and main lecturers Prof. Dr. C. R. Rose; Prof. Dr. U. Rüter
11	Further information The regular attendance at the lectures is strongly recommended. The content of the lectures is prerequisite for the practical course and the seminar.