Module Number **3a**	Title: **Neurocytology, cell differentiation and regeneration of the nervous system**		
Module type: compulsory elective	**Language:** English	**Group Size:** 6 students	
Study semester: 1	**Availability:** winter semester	**Duration:** 1 semester	
Workload: 420 hrs	**Credits:** 14CP	**Contact time:** 124 hrs	**Independent study:** 296 hrs

1	**Courses** a) Lecture 2 PPW b) Practical course 9 PPW
2	**Intended learning outcomes** After completion of this module students (1) will be familiar with the sterile preparation and cultivation of neural stem cells, primary neocortical cell cultures and enrichment/isolation of distinct neural cell types, (2) will able to apply basic immunocytochemical techniques to identify and distinguish neural cell types using light and fluorescence microscopy, (3) will have solid understanding of the development and differentiation of neural cells, (4) will understand the basis of recombinant modulation of endogenous gene expression, (5) will be able to work independently and accurately with laboratory equipment, (6) will be able to analyse and document experimental results according to good scientific practise standards, (7) will be able to present and discuss experimental results and scientific context.
3	**Content** **Lectures:** Neurocytology: Neurons and glial cells - morphology and function in the nervous system, Neural stem cells; Development and differentiation of the nervous system: Induction, Neuro- and gliogenesis, Cell determination, Differentiation and axonal pathfinding, Neurotrophic support and apoptosis; Microglial polarization: Cell fate biofinformatics, CRISPR/CAS9 - gene revolution? Molecular pathophysiology and regeneration: Multiple sclerosis, traumatic nerve injury and regeneration. **Practical course:** The Küry and Müller labs belong to the Department of Neurology and will focus on cultivation and identification of neural cell types from rat brain (neural stem cells, neurons, astrocytes, oligodendrocytes, microglia) and analysis of neural differentiation with the following sets of experiments: Preparation and cultivation of primary cortical mixed cultures; application of light microscopy and immunofluorescence methods to demonstrate morphological cell differentiation and identification of cell maturation markers; Sorting, enrichment and isolation of distinct cell types using MACs or FACS techniques; Cell transfection to modulate endogenous gene expression and cell differentiation; RNA purification and quantification of differentiation markers using pRT-PCR; Polarization of primary microglial cells; Immunoassay (ELISA) to detect secreted immune-associated cytokines. **Final presentation:** At the last day of the module, the students will give a scientific presentation and will defend and discuss the results of the practical course within the scientific context.
4	**Teaching methods** Lectures, practical course with demonstrations and hands-on guidance (everybody will have hands-on experience), oral presentation, supervised protocol writing and data analysis

5	**Prerequisites** **Formal:** Successful completion of module 1. **With regards to content:** basic knowledge of neurobiology
6	**Examination type:** cumulative examination Written exam covering lectures and practical course (70% of total grade) Scientific presentation (30% of total grade)
7	**Requirements for award of credit points** Regular participation in the practical training. Final presentation and discussion of experimental results. Successful participation in the written examination.
8	**Module applicability** (in other study courses) Master Biology
9	**Assessment** The mark given will contribute to the final grade in proper relation to its credits.
10	**Module convenor and main lectures** Dr. R. Akkermann, Dr. K. Azim, Dr. N. Brazda, Dr. V. Estrada, Dr. P. Göttle, J. Gruchot, Prof. Dr. P. Küry, Prof. Dr. H.W. Müller, Dr. J. Schira
11	**Further information** The regular participation in the lectures is strongly recommended. The content of the lectures is prerequisite for the practicals and relevant for the written exam.