Module Number **5c**	Title: **Methods in Neurosciences**		
Module type: compulsory elective	**Language:** English		**Group Size:** 6 - 8 students
Study semester: 1	**Availability:** summer semester		**Duration:** 1 semester
Workload: 420 hrs	**Credits:** 14 CP	**Contact time:** 123 hrs	**Independent Study:** 297 hrs

1 Courses

a) Lectures 3 PPW
b) Practical courses 6 PPW
c) Seminars 2 PPW

2 Intended Learning Outcomes

This module consists of three parts:
1. Testing locomotor behaviour of the rat
2. Histochemical techniques for neuronal and glial characterization
3. Electrophysiology of neurons

After completion of the first part students will be able to describe the general principles in selected methods of locomotor and sensory tests for rodents. They are capable to quantitatively and critically evaluate behavioural deficits and outcome after nervous system injury and disease in comparison to the performance of intact animals.

After attending the second part students will be able to describe the cellular composition of the central nervous system with strong emphasis of developmental changes, cellular function and species differences addressing model species such as mouse and rat in comparison to higher primates and humans. They will be able to describe marker epitopes and their combinations, which will characterize specific cells and the functional or pathophysiological state as a basis for their immunohistochemical identification. They will be capable to explain the production of epitope-specific antibodies. Students will be able to perform tissue preparation and to apply immunohistochemical staining techniques including the appropriate controls as well as microscopic evaluation of the results. They will be able to present orally their experiments and test results to the peers.

After completion of the third part the students will be capable to explain the principles of electrophysiological recordings. They will be able to design and to perform electrophysiological experiments, to document and analyse their results and to summarize their findings in form of a scientific report.

3 Content

In the first part subjects to be dealt with:
1st week: Analysis of locomotor function of spinal cord injured and non-injured rats. General motor behaviour in the BBB open field test, evaluation of precise hind limb movement control and forelimb-hindlimb coordination in the horizontal ladder walking test, detailed automated gait analysis in the CatWalk® test, evaluation of test results.

In the second part students will be introduced to the principals of: Animal anaesthesia and euthanasia. Hands on: Tissue dissection & preparation, tissue fixation methods, and methods for tissue embedding for light- or electron microscopy. The preparation of tissue sections (brain) and the preparation for immunohistochemistry, immunohistochemical staining techniques and final preparation of the tissue for microscopy including microscopic evaluation and data analysis.

	In the third part students will learn to record and to interpret single-unit and network neuronal activities in brain slices and primary cultures using microelectrodes and the patch-clamp technique. Action potentials, spontaneous synaptic activities, voltage- and ligand-gated ion channels will be studied. Neuronal identification will be performed with electrophysiological, pharmacological, immunohistochemical and molecular-biological (single-cell RT-PCR) methods. Transgenic mouse lines with a fluorescent reporter protein expressed under control of a cell-type specific promoter will be provided.
4	**Teaching methods** First part: Lectures, Seminars and Practical Course Second part: Lecture, hands-on training courses, Seminar Third part: Lectures, Seminars and Practical course
5	**Prerequisites** **Formal:** Successful completion of module 1. Bachelor in natural sciences; Proficiency in English level B2 of Common European Framework of Reference for Languages (CEFR); **With regards to content:** Participants have a demonstrable focus on the area of neurosciences**.**
6	**Examination types** Written exam
7	**Requirements for award of credit points** Regular and active participation in seminars and practical courses. Delivery of oral presentation (e.g. Powerpoint) of selected seminal papers and progress report on experimental data. The written examination has to be passed.
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 lecturers** Prof. Dr. Olga A. Sergeeva, Prof. Dr. H.W. Müller, Dr. Hans-J. Bidmon, Prof. Dr. Esther Florin, Dr. Veronica Estrada, Dr. Nicole Brazda, Prof. Alfonso Prieto
11	**Further information** A FELASA certificate is recommended and can be obtained by attending Module 2c "Laboratory Animal Course" in advance. The attendance at lectures is strongly recommended. The content is prerequisite for practicals and seminars.