Module Name Neurobiochemistry

Identification Number	Workload	Credit Points	Term	Offered Every	Start	Duration
MN-BC-BSM08	360 h	12 CP	1st or 2nd term of studying	Summer term	summer term only	7 weeks

1	Course Types	Contact Time	Private Study	Planned Group Size*
	a) Lectures	24 h	80 h	max. 12
	b) Practical/Lab	136 h	76 h	max. 2
	c) Seminar	8 h	36 h	max. 12

2 Module Objectives and Skills to be Acquired

Students who successfully completed this module

- have acquired detailed knowledge about the structure-function relations of ligand-gated ion channels as well as post synaptic proteins and their function within neuronal cells.
- are able to isolate synaptic proteins from recombinant sources.
- can characterize protein interactions between membrane receptors and synaptic proteins on a biochemical level using isothermal titration calorimetry.
- are able to apply the principle of immunodetection to microscopic samples as well as Western blot-based detection techniques.
- have acquired sterile working practice, are able to express synaptic proteins in cultured mammalian cells and analyze their subcellular distribution using fluorescence microscopy.
- are able to express Adeno-associated viruses (AAV) in a cultured mammalian cell line and enrich AAVs suitable for *in vitro* experiments.
- have prepared hippocampal neuron cultures and quantified synaptic structures using semi-automated image processing.
- can independently carry out small scientific projects related to the topic of the module.
- have the ability to process, quantify and evaluate their experimental results.
- have learned how to present research results in oral and written form and to critically discuss scientific publications related to the topic of the module on a professional level.
- are able to transfer skills acquired in this module to other fields of biochemistry.

3 Module Content

- Structure and function of neurons
- Ligand-gated ion channels, post-synaptic proteins, their structures and molecular interaction
- Neuronal receptors in health and disease
- Methods to visualize cellular structures and protein interactions (*in vitro* and *in vivo*)
- Expression of synaptic proteins in cultured mammalian cells and immunostaining analysis
- Preparation of hippocampal neurons from mouse brain
- Fluorescence microscopy and image analysis
- Model organisms: vertebrates – *Mus musculus*, prokaryotes – *E. coli*

4 Teaching Methods

Lectures (including discussions); Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form

5	**Prerequisites (for the Module)** Enrollment in the Master´s degree courses “Genetics and Biology of Aging and Regeneration”, “Neuroscience” or “Biochemistry and Molecular Medicine” **Additional academic requirements** For students of Master “Genetics and Biology of Aging and Regeneration” and “Neuroscience”: Experimental expertise in biochemical techniques (protein biochemistry, cell biology) is mandatory. If basic knowledge is missing, the attendance of the module cannot be continued. Please contact the module coordinator for more information.
6	**Type of Examination** The final examination consists of two parts (Type BC3): Written examination on topics of lectures, seminars and the practical/lab part (1 hour; 50 % of the total module mark), oral poster presentation of (20-30 min; 50 % of the total module mark).
7	**Credits Awarded** Regular and active participation Each examination part at least “sufficient” (see appendix of the examination regulations for details)
8	**Compatibility with other Curricula** Biochemical subject module in the Master´s degree courses “Genetics and Biology of Aging and Regeneration” and “Neuroscience”
9	**Proportion of Final Grade** In the Master´s degree course “Biochemistry and Molecular Medicine”: 10 % of the overall grade (see also appendix of the examination regulations)
10	**Module Coordinator** Prof. Dr. Günter Schwarz, phone 470-6440, e-mail: gschwarz@uni-koeln.de
11	**Further Information** **Participating faculty**: Prof. Dr. Matteo Bergami, Dr. Patricia Brown, Prof. Dr. Natalia Kononenko, Dr. F. Liebsch, Dr. Elisa Motori, Dr. F. Neuser **Literature:** • Kandel, E.R., Schwartz, J.H., Jessell, T. (2014) Principles of Neural Science. 5th edition, McGraw-Hill. Chapters 21, 22, 32. • Further original publications will be handed out at the introduction to the module **General time schedule:** Week 1-5 (Mon.-Fri.): Lectures, practical/lab, preparation for the seminar talk (topic and date will be arranged individually); Week 6 (Mon.-Fri.): Preparing the poster for presentation; Week 7 (Mon.-Fri.): Preparation for the written examination **Note:** The module contains hands-on laboratory work conducted by small groups of students and individually and is taught in course rooms and research laboratories. The module does not contain computer-based practicals/research as a main component.

* 2 students from the Master´s degree course “Genetics and Biology of Aging and Regeneration”, 2 students from the Master’s degree course “Neuroscience” and 8 students from the Master’s degree course “Biochemistry and Molecular Medicine”.