Module Name
Neurobiochemistry

Type of Module	**Module Code**
o Advanced Module	Neurobiochemistry

Identification Number	**Workload**	**Credit Points**	**Term**	**Offered Every**	**Start**	**Duration**
MN-B-SM (N 3)	360 h	12 CP	2nd term of studying	Summer term, 1st half	Summer term only	7 weeks

1	**Course Types**	**Contact Time**	**Private Study**
	a) Lectures	24 h	80 h
	b) Practical/Lab	136 h	76 h
	c) Seminar	8 h	36 h

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 and size exclusion chromatography.
- 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

3	**Module Content** (continued) • 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; 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 of Science degree course "Genetics and Biology of Aging and Regeneration", "Neuroscience" or in the Master's degree course "Biochemistry and Molecular Medicine" **Additional academic requirements** 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: One hour written examination on topics of lectures, seminars and the practical/lab part (50 % of the total module mark), oral presentation (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** Optional compulsory module in the Master's degree course "Biochemistry and Molecular Medicine"
9	**Proportion of Final Grade** 12.0 %
10	**Module Coordinator** Prof. Dr. Günter Schwarz, phone 470 6440, e-mail: gschwarz@uni-koeln.de

11	**Further Information** https://schwarzlab.uni-koeln.de/teaching-lehre/neurobiochemistry **Participating faculty**: Dr. Patricia Brown, 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, seminar talk and practical/lab; Week 6 (Mon.-Fri.): Preparation for the oral data presentation based on a poster; Week 7 (Mon.-Fri.): Preparation for the written examination **Note:** The module contains hand-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. **Introduction to the module:** April 8, 2026 at 09:00 a.m., Zülpicher Str. 47, Room 493 (further information/link will be sent to your Smail-Account) **Written examination:** June3, 2026, second/supplementary examination August 27, 2026; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.