Sensory Perception, Synaptic Transmission, Receptor Repertoires and Evolution						
Identification number	**Workload**	**Credit points**	**Term of studying**		**Frequency of occurence**	**Duration**
M-Neuro-AM3 a-c	360 h	12 CP	1st or 2nd term of studying		Summer term, 2nd half	7 weeks

1	**Type of lessons**	**Contact times**	**Self-study times**	**Intended group size***
	a) Lectures	20 h	30 h	max. 4
	b) Practical/Lab	156 h	120 h	max. 4
	c) Seminar	10 h	24 h	max. 4

2 Aims of the module and acquired skills

Students who successfully completed this module …

- have acquired in depth knowledge on identification, isolation, and functional analysis of transmitter, sensory receptors and ligand-gated ion channels and their function within neuronal cells as well as on the evolution of receptor structure and function.
- have working skills necessary to tackle the analysis of membrane receptors (see contents of the module) and are able to independently design and perform small scientific projects related to topics of the module.
- have acquired a throughout insight into the mechanisms of neurotransmitter release and presynaptic plasticity
- have obtained an understanding of the advantages and disadvantages of different model systems (mammalian cell culture, larval fish).
- 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 biology.

3 Contents of the module

- Transfection of neurotransmitter receptors in HEK cells, quantification
- Primary mouse neuronal cell culture
- Isolation of membrane proteins and Western Blot
- Ca^{2+} fluorimetry of receptor-expressing cell lines and presynaptic neurotransmission in mouse primary neurons
- Dose-response curves and signal transduction of insect octopamine receptors
- Data mining of receptor gene families in teleost genomes (blast, HMM)
- Phylogenetic trees and sequence alignments (NJ, ML, MAFFT, sequence logo)
- Generating a probe for in situ hybridisation (PCR, colony PCR, miniprep, electrophoresis)
- Whole mount *in situ* hybridisation of larval zebrafish
- Microinjection of zebrafish oocytes for analysis of transgenes
- Fluorescence microscopy, 3D visualization of neuronal function using Amira

4 Teaching/Learning methods

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

5	**Requirements for participation** Enrollment in the Master´s degree course "Biological Sciences" or in the Master´s degree course "Experimental and Clinical Neurosciences" **Additionally recommended:** A strong interest and basic knowledge in neurobiology is required. Participation in module MN-B-SM (N 2) (1st half of the summer term) is advantageous.
6	**Type of module examinations** The final examination consists of three parts: 30 min oral examination about topics of the lectures and the practical/lab part (50 % of the total module mark), oral presentation (25 % of the total module mark) and seminar paper (25 % of the total module mark)
7	**Requisites for the allocation of credits** Regular and active participation; Each examination part at least "sufficient" (see appendix of the examination regulations for details)
8	**Compatibility with other Curricula*** Elective module in the Master´s degree course "Biological Sciences"
9	**Significance of the module mark for the overall grade** In the Master´s degree course "Experimental and Clinical Neurosciences": 12 % of the overall grade (see also appendix of the examination regulations)
10	**Module coordinator** Prof. Dr. Sigrun Korsching, phone 470-4843, e-mail: sigrun.korsching@uni-koeln.de
11	**Additional information** **Subject module** of the Master´s degree course "Biological Sciences", **Focus of research:** (N) Neurobiology; (G) Genetics and Cell Biology **Participating faculty:** Prof. Dr. A. Baumann, Dr. N. Kononenko, Prof. Dr. S. Korsching **Literature:** • Kandel, E.R., Schwartz, J.H., Jessell, T. (2000) Principles of Neural Science. 4th edition, NcGraw-Hill. Chapters 21, 22, 32 • Purves, D., Augustine, G.J., Fitzpatrick, D., Hall. C.W. *et al.* (2007) Neuroscience. 4th edition, Palgrave Macmillan. Chapters 5-7, 14 • Siegel, G.J., Albers, R.W., Brady, S.T., Price, D.L. (2006) Basic Neurochemistry. 7th edition, Academic Press. Chapters 10-18, 28, 29, 31, 40 • Alberts, B., Johnson, A., Lewis, J. *et al.* (2002) Molecular Biology of the Cell. 4th edition, Taylor & Francis. Chapter 8 • Berg, J.M., Tymoczko, J.L., Stryer, L. (2006) Biochemistry. 6th edition, Palgrave Macmillan **General time schedule:** Week 1-6 (Mon.-Fri.): Lectures, practical/lab, data evaluation, preparation and presentation of seminar talk as well as writing and presenting results report; Week 7 (Mon.-Fri.): Preparation for the oral examination **Note:** The module contains hand-on laboratory work conducted by small groups of students and is taught in research laboratories. The module does not contain computer-based practicals/research as a main component. **Introduction to the module:** May 25, 2020 at 9:00 a.m., Cologne Biocenter, room 1.007 (first floor) **Oral examination:** July 17, 2020, second/supplementary examination August 28, 2020; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.

* 3 students from the Master´s degree course "Biological Sciences" and 1 student from the Master´s degree course "Experimental and Clinical Neurosciences"