

Cellular and Molecular Neurophysiology					
Identification number	Workload	Credit points	Term of studying	Frequency of occurrence	Duration
MN-B-SM (N 5)	360 h	12 CP	1 st or 2 nd term of studying	Summer term, 2 nd half	7 weeks
1	Type of lessons		Contact times	Self-study times	Intended group size*
	a) Lectures		20 h	40 h	max. 6
	b) Practical/Lab		100 h	160 h	max. 2
	c) Seminar		10 h	30 h	max. 6
2	<p>Aims of the module and acquired skills</p> <p>Students who successfully completed this module ...</p> <ul style="list-style-type: none"> • have acquired an understanding of how passive and active intrinsic electrophysiological and biophysical properties/mechanisms shape neuron type-specific functional phenotypes. • have an understanding of plasticity in neurons and microcircuits • have acquired an understanding of circuits of monoaminergic neurons in vertebrates as well as invertebrates and how these circuits generate behavior • have acquired a solid understanding of cellular electrophysiological and immunohistochemical methods. • are able to apply intracellular recording and imaging techniques used in neurobiology (see contents of the module) • able to independently design and perform small scientific projects related to topics of the module. • are able to analyze electrophysiological data using the Spike 2, Igor Pro or Phyton. • are able to analyze images using ImageJ/Fiji. • have learned how to present research results in oral and written form and critically discuss scientific publications related to the module's topic on a professional level. • are able to transfer skills acquired in this module to other fields of biology. 				

<p>3</p>	<p>Contents of the module</p> <p>The module focuses on the cellular mechanisms of neuronal function and its modulation under physiological and pathophysiological conditions. The functions of nervous systems are determined by the cellular properties of their neurons and the synaptic connections between these neurons. For adaptation to changing tasks or environmental conditions, it is crucial that these cellular parameters are adaptable and can be modulated. Many brain diseases are associated with dysregulation of neuronal and synaptic properties or their modulatory control.</p> <p>Through a combination of lectures, seminars, practical exercises, and research projects, students learn about the cellular mechanisms that mediate neuronal function. Participants will analyze the function of neurons and how it can be modulated using single-cell electrophysiological, labeling, and neurochemical methods. Laboratory work focuses on conducting self-designed research projects by formulating and performing rigorous experiments.</p> <ul style="list-style-type: none"> • Basic properties of excitable membranes • Functional analysis of membrane properties and neuronal activity • Intracellular recordings of neuronal activity • Analysis of synaptic interaction of neurons • Modulation of membrane properties by the monoamine transmitters/modulators dopamine and serotonin • Functional properties of monoaminergic circuits in vertebrates and invertebrates • Immunohistological analysis of monoamine transmitter networks • Intracellular staining techniques and fluorescence and confocal laser scanning microscopy • Analysis of electrophysiological data with Spike2, Igor Pro or Python.
<p>4</p>	<p>Teaching/Learning methods</p> <ul style="list-style-type: none"> • Lectures; Practical/Lab (Project work); Seminar; Guidance to independent research; Training on presentation techniques in oral and written form.
<p>5</p>	<p>Requirements for participation</p> <p>Enrollment in the Master’s degree course “Biological Sciences” or in the Master’s degree course “Klinische und Experimentelle Neurowissenschaften”</p> <p>Additional academic requirements:</p> <p>An advanced knowledge of neuroscience is essential. E.g.: Previous attendance of the lecture module “Neurobiology: Genes, Circuits, and Behavior (N)”.</p>
<p>6</p>	<p>Type of Examination</p> <p>The final examination consists of two parts: Oral presentation (20-30 min; 50 % of the total module mark), written report (50 % of the total module mark).</p>
<p>7</p>	<p>Requisites for the allocation of credits</p> <p>Regular and active participation; Passed seminar paper Each examination part at least “sufficient” (see appendix of the examination regulations for details)</p>
<p>8</p>	<p>Compatibility with other Curricula*</p> <p>Elective module in the Master’s degree course “Clinical and Experimental Neurosciences”</p>
<p>9</p>	<p>Significance of the module mark for the overall grade</p> <p>In the Master’s degree course “Biological Sciences”: 15 % of the overall grade (see also appendix of</p>

	the examination regulations)
10	<p>Module coordinator Prof. Dr. Peter Kloppenburg, phone 470-5950, e-mail: peter.kloppenburg@uni-koeln.de</p>
11	<p>Additional information</p> <p>Subject module of the Master´s degree course “Biological Sciences”, Focus of research: (N) Neurobiology</p> <p>Participating faculty: Dr. S. Hess, Prof. Dr. P. Kloppenburg, and guests.</p> <p>Literature:</p> <ul style="list-style-type: none"> Information about textbooks and other reading material will be given on the ILIAS representation of the course () <p>General time schedule: Week 1-6 (Mon.-Fri.): Lectures, practical/lab work, and preparation for the seminar talk (held at the end of week 6) as well as writing seminar paper; Week 7 (Mon.-Fri): Preparation for the written examination</p> <p>Note: The module contains hands-on laboratory work conducted individually and is taught in course rooms. The module does not contain computer-based practicals/research as a main component.</p> <p>Introduction to the module: July 25, 2022 at 9:00 a.m., Cologne Biocenter, room 1.007 (first floor); for preparation for the module before this introduction, see ILIAS link under literature</p> <p>Note: Material for mandatory preparation before the course will be made available on the ILIAS representation of the course no later than July 11.</p> <p>Examination: September 09, 2022, second/supplementary examination October 07, 2022; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.</p>

* 4 students from the Master´s degree course “Biological Sciences” and 2 students from the Master´s degree course “Klinische und Experimentelle Neurowissenschaften”.