

<b>Synaptic Physiology in Health and Disease</b>					
<b>Identification number</b>	<b>Workload</b>	<b>Credit points</b>	<b>Term of studying</b>	<b>Frequency of occurrence</b>	<b>Duration</b>
MN-B-EM (am11 neuro)	180h	6 CP	During term break	Winter term	3 weeks
<b>1</b>	<b>Type of lessons</b>		<b>Contact times</b>	<b>Self-study times</b>	<b>Intended group size*</b>
	a) Lectures		10 h	30 h	max. 6
	b) Practical/Lab		74 h	66 h	
<b>2</b>	<b>Aims of the module and acquired skills</b> Students who successfully completed this module ... <ul style="list-style-type: none"> <li>• have acquired in-depth knowledge on identification and functional analysis of synapses in the mouse brain and spinal cord.</li> <li>• have obtained an understanding of the advantages and disadvantages of different model systems (primary neuronal cell culture, ex-vivo mouse brain slice culture, and in-vivo mouse brain).</li> <li>• have acquired experimental skills in state-of-the art imaging of synaptic physiology and can independently design and perform small scientific projects related to the topics of the module.</li> <li>• have learned how to present research results in oral and written form and to critically discuss experimental results on a professional level.</li> <li>• can apply acquired knowledge in clinical and experimental fields of neuroscience and to other fields of biology.</li> </ul>				
<b>3</b>	<b>Contents of the module</b> <ul style="list-style-type: none"> <li>• Primary culture of mouse cortical neurons, plasmid transfections</li> <li>• Organotypic slice culture of mouse cortex and cerebellum and viral transductions</li> <li>• Imaging of synaptic activity using GCAMP- and pFluorin-based reporters in mouse primary neurons and organotypic slice culture</li> <li>• Analysis of mouse models of neurodegenerative diseases</li> <li>• Identification and analysis of synapses in electron microscopy (EM) images</li> <li>• Fluorescence microscopy and quantitative analysis of microscopy data</li> </ul>				
<b>4</b>	<b>Teaching/Learning methods</b> <ul style="list-style-type: none"> <li>• Lectures; Practical/Lab (Project work); Guidance to independent research; Training on presentation techniques in oral and written form.</li> <li>• The blended learning approach is used for the entire module (online material for self-study will be available for downloading).</li> <li>• Some lectures will be given in “active leaning” form, i.e. students prepare answers to pre-assigned topics and then “teach” that topic to their peers.</li> </ul>				

5	<p><b>Requirements for participation</b></p> <p>Enrollment in the Master's degree course "Biological Sciences" or in the Master's degree course "Experimental and Clinical Neuroscience".</p> <p><b>Additionally recommended:</b> Successful completion of the "Lecture Neurobiology: Genes, Circuits, and Behavior" module or "the Neural Function I" module, or participation in a neuroscience-oriented module that provides equivalent content.</p>
6	<p><b>Type of module examinations</b></p> <p>The final examination consists of the oral presentation about the practical work</p>
7	<p><b>Requisites for the allocation of credits</b></p> <p>Regular and active participation; pass in the exam.</p>
8	<p><b>Compatibility with other Curricula*</b></p> <p>Elective module in the Master's degree course "Experimental and Clinical Neuroscience"</p> <p>Elective module in the Master's degree course "Biological Sciences"</p>
9	<p><b>Significance of the module mark for the overall grade</b></p> <p>In the Master's degree course "Experimental and Clinical Neuroscience": 6 % of the overall grade (see also appendix of the examination regulations)</p> <p>In the Master's degree course "Biological Sciences": not applicable (pass or fail).</p>
10	<p><b>Module coordinator</b></p> <p>Prof. Dr. Natalia L. Kononenko, phone 470-84302, e-mail: natalia.kononenko@uk-koeln.de</p>
11	<p><b>Additional information</b></p> <p><b>Elective module</b> of the Master's degree course "Biological Sciences" and the Master's degree course "Experimental and Clinical Neuroscience".</p> <p><b>Focus of research:</b> (N) Neurobiology</p> <p><b>Participating faculty:</b> Prof. Dr. N. Kononenko, Prof. Dr. Graziana Gatto, Prof. Dr. Olivia Masseck, Andrew Hill.</p> <p><b>Literature:</b></p> <ul style="list-style-type: none"> <li>• Kandel, E.R., Schwartz, J.H., Jessell, T. (2000) Principles of Neural Science. 4<sup>th</sup> edition, NcGraw-Hill. Chapters 21, 22, 32</li> <li>• Purves, D., Augustine, G.J., Fitzpatrick, D., Hall. C.W. <i>et al.</i> (2007) Neuroscience. 4<sup>th</sup> edition, Palgrave Macmillan. Chapters 5-7, 14</li> <li>• Siegel, G.J., Albers, R.W., Brady, S.T., Price, D.L. (2006) Basic Neurochemistry. 7<sup>th</sup> edition, Academic Press. Chapters 10-18, 28, 29, 31, 40</li> </ul> <p><b>General time schedule:</b> February 17 to March 10, 2026: Lectures, practical/lab, data evaluation, and preparation of oral presentations. Project presentations: March 10, 2026 at 16:00.</p> <p><b>Note:</b> The module contains hands-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.</p> <p><b>Registration deadline: December 1, 2025.</b></p> <p><b>Introduction to the module: February 10, 2026 at 14:00,</b> Center for Metabolism Research (Building 51), Robert-Koch-Str. 10, seminar room ground floor, D-50931 Cologne.</p>