

Computational Neuroscience					
Identification number	Workload	Credit points	Term of studying	Frequency of occurrence	Duration
M-Neuro-AM1 a-c	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		30 h	60 h	max. 10
	b) Practical/Lab		100 h	130 h	max. 10
	c) Seminar		12 h	28 h	max. 10
2	Aims of the module and acquired skills				
	<p>Students who successfully completed this module ...</p> <ul style="list-style-type: none"> • have acquired a general overview over the field of computational neuroscience. • can use Python for scientific programming, data analysis, and computational modeling as well as for visualization of data and analysis of results. • have gained an understanding of how electrical properties of neurons can be represented mathematically. • can describe aspects of neural network connectivity using graph theoretical concepts. • can perform basic spiking neural network simulations with NEST. • are able to extract and condense information from the neuroscientific literature. • have improved their overall analytical skills. • have learned how to present research results 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 scientific fields. 				
3	Contents of the module				
	<ul style="list-style-type: none"> • Fundamentals and selected topics of computational neuroscience • Scientific programming with Python • Analysis of electrophysiological data with Python • Spike train statistics and stochastic point processes • Neural coding and plasticity • Mathematical descriptions of neurons and networks • Ordinary differential equations • Graph theory of neural networks • Phase oscillator models of neural interactions • Introduction to the neural network simulation tool NEST 				
4	Teaching/Learning methods				
	<ul style="list-style-type: none"> • Lectures; Programming/mathematical exercises; Seminar; Guidance to independent research; Training on presentation techniques in oral and written form 				

5	<p>Requirements for participation</p> <p>Enrollment in the Master's degree course "Biological Sciences" or in the Master's degree course "Experimental and Clinical Neurosciences"</p> <p>Basic knowledge of neurobiology is required, e.g. from the modules <i>Essentials in Neuroscience</i> or <i>Neural Function I: From experiments to Analysis</i>. Some programming experience in any language is highly recommended.</p>
6	<p>Type of module examinations</p> <p>The final examination consists of three parts: Two hours written examination about topics of the lectures and the practical part (50 % of the total module mark), oral presentation about a scientific paper (25 % of the total module mark) and seminar paper (= written and programming exercises; 25 % of the total module mark)</p>
7	<p>Requisites for the allocation of credits</p> <p>Regular and active participation; Each examination part at least "sufficient" (see appendix of the examination regulations for details)</p>
8	<p>Compatibility with other Curricula*</p> <p>Elective module in the Master's degree course "Biological Sciences"</p>
9	<p>Significance of the module mark for the overall grade</p> <p>In the Master's degree course "Experimental and Clinical Neurosciences": 12 % of the overall grade (see also appendix of the examination regulations)</p>
10	<p>Module coordinator</p> <p>Prof. Dr. Martin Nawrot, phone 470-7307, e-mail: mnawrot@uni-koeln.de</p>
11	<p>Additional information</p> <p>Subject module of the Master's degree course "Biological Sciences", Specialization: (N) Neurobiology: Genes, Circuits, and Behavior</p> <p>Participating faculty: Prof. Dr. S. van Albada, Prof. Dr. S. Daun, Prof. Dr. M. Nawrot, Dr. V. Rostami</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 (https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_2815610.html) <p>General time schedule: Week 1 (Mon.-Thu.): Seminar, lectures and practical sessions; Week 2-6 (Mon.-Thu.): Lectures and practical sessions; Week 1-6 (Fri.): Self-study time; Week 7 (Mon.-Thu.): Preparation for the written examination</p> <p>Note: The module contains computer-based practical sessions as a main component.</p>

* 4 students from the Master's degree course "Experimental and Clinical Neurosciences", if more students apply for the module, the number could be increased.