

Module Name Computational Neuroscience						
Type of Module ○ Advanced Module				Module Code Computational Neuroscience		
Identification Number	Workload	Credit Points	Term	Offered Every	Start	Duration
MN-B-SM (N 6)	360 h	12 CP	2 nd term of studying	Summer term, 2 nd half	Summer term only	7 weeks
1	Course Types		Contact Time		Private Study	
	a) Lectures		30 h		60 h	
	b) Practical/Lab		100 h		130 h	
	c) Seminar		12 h		28 h	
2	Module Objectives and Skills to be Acquired					
	Students who successfully completed this module					
	<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	Module Content					
	<ul style="list-style-type: none"> • Fundamentals and selected topics of computational neuroscience • Scientific programming with Python • Analysis of electrophysiological and behavioral 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	<p>Teaching Methods</p> <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>Prerequisites (for the Module)</p> <p>Enrollment in the Master's of Science degree course "Neuroscience" or in the Master's degree course "Computational Biology" or in the Master's degree course "Experimental and Clinical Neuroscience" or in the Master's degree course "Computational Sciences" or in the Master's degree course*Physics" or in the Master's degree course "Informatics".</p> <p>Additional academic requirements</p> <p>Previous attendance of the lecture module Neuroscience, or successful participation in the module Neural Function I, or equivalent; Some programming experience in any language is highly recommended but not required.</p>
6	<p>Type of Examination</p> <p>The final examination consists of two parts: 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).</p>
7	<p>Credits Awarded</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>Optional compulsory module in the Master's degree course "Computational Biology", the Master's degree course "Experimental and Clinical Neuroscience" and in the Master's degree course "Computational Sciences". Students from Physics or Computer Science, please contact module coordinator; crediting requires approval of study coordination office.</p>
9	<p>Proportion of Final Grade</p> <p>12.0 %</p>
10	<p>Module Coordinator</p> <p>Prof. Dr. Martin Nawrot, phone 470 7307, e-mail: nawrot-office@uni-koeln.de</p>

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Further Information

Participating faculty: Prof. Dr. S. van Albada, Prof. Dr. M. Nawrot, Dr. V. Rostami, Dr. Azamt Yeldesbay, Dr. Alexandra Chatzikalymniou, Felix Schmitt, Ibrahim Tunc, Clemens Engelhardt

Literature:

- Information about textbooks and other reading material will be provided via mail.

Location: Biocenter, Zülpicherstr. 47B, Room 2.009 (2nd floor)

General time schedule: Week 1-6 (Mon.-Wed + Fri. from 10:15 until 16:00): full day teaching (lectures, practical sessions, tutorials). Week 1-6 (Thu): Self-study time. The dates for the literature seminar will be announced in the preparatory meeting. Week 7: Preparation for the written exam. A detailed schedule will be handed out during the preparatory meeting.

Note: The module contains computer-based practical sessions as a main component.

Introduction to the module: June 01, 2026 at 15:00h, online via Zoom (further information/link will be sent to your Smail-Account); for preparation to the module before this introduction check your smail account.

Written examination: Thu, July 23, 2026, second/supplementary examination Fri, Aug 28, 2026; the latter date may vary if students and module coordinator agree. More details will be given at the beginning of the module.