HANDBOOK OF MODULES
Master of Neuroscience

Jointly carried by
School of Mathematics and Science (Faculty V)
School of Medicine and Health Sciences (Faculty VI)

www.uni-oldenburg.de/en/master-neuroscience

Version 2021 (with preview of 2022)
Overview M.Sc. Neuroscience

Compulsory Elective, 60 ECTS

15 ECTS
Research Module

6 ECTS
Skills Mod.

9 ECTS
any Neuro Module

30 ECTS
Background Modules

Thesis Module, 30 ECTS

30 ECTS
Master Thesis Module

Elective, 30 ECTS

any Neuroscience Modules, other M.Sc. courses, semester abroad

Interdisciplinary / Neuroscience


Recommendations:
- First semester starting point: The combination of ‘biological foundations’ (neu230) and ‘Method’ (neu710) is mandatory but recommended, as it provides the basis knowledge for other modules.
- Research modules: any individual/research projects in a neuroscience lab. Please that the separate list of project options for each semester in Stud.IP. Before joining the group of a supervisor for a research module, it is recommended to take at least one of the background modules this supervisor teaches. In many groups, research modules are flexible in time, e.g. allowing combination with semester-long courses, including courses from other Master’s programs.
- Elective: Please find a list of approved courses from other M.Sc. programs at our homepage http://www.uni-oldenburg.de/en/master-neuroscience.de
# Background Module - Winter

**neu350 - Biological Foundations of Neuroscience**

<table>
<thead>
<tr>
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<th>Biological Foundations of Neuroscience</th>
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<tbody>
<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td>Responsible persons</td>
<td>Puller, Christian (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Neidhardt, John (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Koch, Karl-Wilhelm (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Hartmann, Anna-Maria (Authorized examiners)</td>
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<td></td>
<td>Greschner, Martin (Authorized examiners)</td>
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<td></td>
<td>Klump, Georg Martin (Authorized examiners)</td>
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<td></td>
<td>Owczarek-Lipska, Marta (Authorized examiners)</td>
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<tr>
<td>Prerequisites</td>
<td>Recommended in combination with &quot;Research Techniques in Neuroscience&quot;</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>Upon successful completion of this course, students have acquired basic knowledge of fundamental principles of neurobiology. The aim of this background module is to provide a solid biological knowledge base required for studying advanced neuroscientific topics. It is designed in particular, but not exclusively, for students joining the local M.Sc. Neuroscience program from previous study paths with little (neuro)biological background.</td>
</tr>
<tr>
<td></td>
<td>++ Neurosci. knowlg.</td>
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<td>+ Scient. Literature</td>
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<td>+ Social skills</td>
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<td>+ Interdiscipl. knowlg.</td>
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<td></td>
<td>+ Scientific English</td>
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<td>Module contents</td>
<td>The background module consists of a lecture series and an associated seminar. The following topics are covered:</td>
</tr>
<tr>
<td></td>
<td>• Biochemistry</td>
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<tr>
<td></td>
<td>• Genetics</td>
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<tr>
<td></td>
<td>• Electrophysiology</td>
</tr>
<tr>
<td></td>
<td>• Cell biology</td>
</tr>
<tr>
<td></td>
<td>• Systems Neuroscience</td>
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<td>Reader's advisory</td>
<td>Neuroscience, newest edition; Purves; Sinauer Associates</td>
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<td></td>
<td>Stryer Biochemistry and Alberts et al. Molecular Biology of the Cell, several editions</td>
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<td>Molecular Biology of the Gene, Watson (Pearson Verlag)</td>
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<td>Links</td>
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<td>Languages of instruction</td>
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<td>Wahlpflicht / Elective</td>
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<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<td>Examination</td>
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<td>Type of examination</td>
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<td>at the end of the course</td>
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<td>Seminar</td>
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<td>Total time of attendance for the module</td>
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### bio845 - Introduction to Development and Evolution

<table>
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<th>Introduction to Development and Evolution</th>
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<td>Credit points</td>
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<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<td>Sienknecht, Ulrike (Module responsibility)</td>
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<td>Sienknecht, Ulrike (Module counselling)</td>
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<td></td>
<td>Sienknecht, Ulrike (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Claußen, Maike (Authorized examiners)</td>
</tr>
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</table>

**Prerequisites**

**Skills to be acquired in this module**

Upon successful completion of this course, students

- know the fundamental problems organisms share in development
- know the common basic steps of ontogenesis after comparing the life cycles of different species (both vertebrates and invertebrates)
- know the fundamentals of the genetic control of cell-fate specification, morphogenesis, and organogenesis
- know the principles of gene regulatory networks in development and are able to explain examples
- are able to explain and discuss mechanisms of development across taxonomic groups and questions about the evolution of developmental mechanisms
- have in-depth knowledge of the development of animal nervous systems, including cellular and net-work properties

**skills:**

++ deepened biological expertise
+ deepened knowledge of biological working methods
++ interdisciplinary thinking
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ ability to perform independent biological research
+ teamwork

**Module contents**

Lectures on the fundamentals and concepts of developmental biology, including evolutionary aspects. Parallel seminars matching the topics of the lectures and emphasizing discussion. Lecture topics:

- Introduction to Developmental Biology
- Cell-Cell Communication
- Differential Gene Expression (I and II)
- Early Development of Vertebrates, Gastrulation
Neurulation  
Brain Development  
Axonal Growth, Target Selection, Synaptogenesis and Refinement  
Neural Crest  
Mesoderm Development  
Morphogenesis  
Developmental Mechanisms of Evolutionary Change  
Model Organisms in Developmental Biology  
Transgenic Mice  
Medical Implications of Developmental Biology

**Reader's advisory**

**Literature:**

*textbook:* Gilbert S.F.: Developmental Biology, Macmillan Publishers Ltd, 11th edition 2016 (current edition); and current literature on course topics

**Links**

<table>
<thead>
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<th>Language of instruction</th>
<th>English</th>
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<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

organismic biology, developmental biology, evolutionary biology, neurobiology, genetics, molecular biology

<table>
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<th>Time of examination</th>
<th>Type of examination</th>
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<td>Final exam of module</td>
<td>same winter term</td>
<td>oral exam of 30 minutes (or written exam*)</td>
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*Pending approval PO*

**Course type**

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<th>Frequency</th>
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**Total time of attendance for the module**

90 h
## bio846 - Lab Exercises in Development and Evolution

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<tr>
<td>Credit points</td>
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### Applicability of the module
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

### Responsible persons
- Sienknecht, Ulrike (Module responsibility)
- Sienknecht, Ulrike (Module counselling)
- Sienknecht, Ulrike (Authorized examiners)
- Claußen, Maike (Authorized examiners)
- Ebbers, Lena (Authorized examiners)

### Prerequisites
- **mandatory** prerequisite is the module bio845 (neu110) (Introduction to Development and Evolution)

### Skills to be acquired in this module

Upon successful completion of this course, students have skills in methods of developmental biology:

- are capable of performing live embryo husbandry
- are able to carry out in-ovo stainings
- are familiar with the use of embryonic stage discrimination standards for model organisms
- document the observed embryonic stages by drawings with anatomical labelling
- are familiar with tissue preparation (including cryosectioning), the use of different molecular markers, and immunohistological staining methods
- microscopy, data analysis, and photographic data documentation
- know the standards of proper documentation of research data and the universal format of a lab notebook
- know how to carry out formal laboratory reports (and the structure of a scientific paper)
- have basic knowledge in the field of auditory system development
- have basic knowledge of the organisation of the auditory system across vertebrate groups
- have basic knowledge of the development of the middle and inner ear, as well as selected auditory brain centres

are able to summarize current hypotheses about the evolution of the auditory system in vertebrates skills:

++ deepened biological expertise
++ deepened knowledge of biological working methods
++ data analysis skills
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
++ ability to perform independent biological research
+ data presentation and discussion (written and spoken)
+ teamwork
**Module contents**

Lab exercises in developmental biology of auditory research model organisms, such as chicken and mouse embryos. Practical introduction to methods, such as in-ovo live observation; developmental stage discrimination and description, tissue preparation for histology, sectioning, staining, and microscopy, including data analyses. Seminars in the field of auditory system development and methods based on current literature.

**Reader's advisory**


**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
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<td>MM (Mastermodul / Master module)</td>
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<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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**Vorkenntnisse / Previous knowledge**

Organismic biology, experience with lab work.

<table>
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<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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**Course type**

Exercises

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# bio605 - Molecular Genetics and Cell Biology

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<td>Credit points</td>
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**Applicability of the module**
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

**Responsible persons**
- Neidhardt, John (Authorized examiners)
- Koch, Karl-Wilhelm (Module counselling)
- Thedieck, Kathrin (Module counselling)

**Prerequisites**
- BSc (Biologie, Biochemie)

**Skills to be acquired in this module**
- ++ deepened biological expertise
- ++ deepened knowledge of biological working methods
- ++ data analysis skills
- ++ interdisciplinary thinking
- + critical and analytical thinking
- + independent searching and knowledge of scientific literature
- + data presentation and discussion in German and English (written and spoken)
- + teamwork
- + ethics and professional behaviour
- + project and time management

Addressing students with an emphasis on molecular biology, molecular genetics, cell biology, and neurobiology

**Module contents**
- Lecture: To improve knowledge in molecular genetics, molecular biology and cell biology in correlation with human diseases.
- Exercise: Learn to transfer the theoretical knowledge to experiments. Gaining methodological knowledge in molecular genetics, cell biology and therapeutic approaches. Initial training on how to perform research projects.
- Subjects of the lecture and seminar: Molecular bases of neurodegenerative diseases, structure and function of DNA/RNA/proteins/membranes, cytoskeleton, cell cycle, programmed cell death, cells in the social structure.
- Exercises: Learning current methods of molecular biology and human genetics; high throughput technologies, introduction to cell cultivation techniques.

**Reader's advisory**
- Textbooks of Cell Biology

**Links**
- [http://www.uni-oldenburg.de/humangenetik/](http://www.uni-oldenburg.de/humangenetik/)

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Module capacity**
- 15

**Reference text**
- associated with bio900

**Modulart / typ of module**
- Wahlziel (Wahlmodul) / Master module

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**
- Zellbiologische Grundkenntnisse, Genetik, Biochemie

**Examination**
- Time of examination: written examination (70 %), paper(s) presentation 30 %; not graded: signed lab protocols, regular active participation is required for the module to be passed.

**Course type**

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**Total time of attendance for the module**

0 h
neu320 - Introduction to Neurophysics

Module label: Introduction to Neurophysics
Module code: neu320
Credit points: 6.0 KP

Applicability of the module
- Master's Programme Neuroscience (Master) > Background Modules

Responsible persons
- Anemüller, Jörn (Authorized examiners)

Prerequisites
- recommended in semester: 3 (with Matlab prereq.: 1)

Skills to be acquired in this module
++ Neurosci. knowlg.
+ Independent research
+ Scient. Literature
++ Interdiscipl. knowlg.
++ Maths/Stats/Progr.
+ Data present./disc.

Students will learn to recognize the dynamics in neuronal networks as the result of an interplay of physical, chemical and biological processes. Overview over major physical measurement procedures for the quantification of structure and function in neuronal systems. Using the language of mathematics as a fundamental tool for the description of underlying biophysical processes with stochastic, linear algebra, differential equations. Information as represented on different length- and timescales: From microscopic processes to macroscopic functional models. Learning and adaptation as adjustment of a biophysical system to its environment.

Module contents
- Biophysics of synaptic and neuronal transmission
- Single neuron models: Hodgkin Huxley model, integrate and fire model, firing rate model
- Biophysics of sensory systems in the auditory, visual and mechano-sensory modality
- Description of neuronal dynamics: Theory of dynamical systems, from microscopic to macroscopic activity - Principles of neuronal activity measurements: from single-cell recordings to EEG, MEG and fMRI
- Functional description of small neuronal networks: Receptive fields and their description with linear and non-linear models - The neuronal code: Spikes, spike trains, population coding, time- vs. rate-code - Decoding neuronal activity and its applications
- Simulation of artificial neural networks as a functional model, Hopfield network, Boltzmann machine, Perceptron and deep networks - Informationtheoretic approaches, stimulus statistics, entropy, mutual information
- Learning and plasticity, conditioning and reinforcement learning, Hebbian learning, long-term potentiation and long-term depression

Reader's advisory
- Chow, Gutkin, Hansel, Meunier, Dalibard (Eds.): Methods and Models in Neurophysics (2003)
- Galizia, Lledo (Eds.): Neurosciences, from molecule to behauvior (2013)
- Gerstner, Kistler, Naud, Paninski: Neuronal Dynamics - From single neurons to networks and models of Cognition (2014)

Links
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: winter term / annually
- Module capacity: 30
  Registration procedure / selection criteria: StudIP
### Reference text
- Recommended in combination with: 5.04.4012 Informationsverarbeitung und Kommunikation (phy350)
- Will also be offered in "M.Sc. Physik, Technik, Medizin"

### Module level / module level

### Modulart / typ of module
- Pflicht o. Wahlpflicht / compulsory or optional

### Lehr-/Lernform / Teaching/Learning method
- Master of Science: Neuroscience

### Vorkenntnisse / Previous knowledge
- Computer programming (preferably Matlab), basic mathematics (statistics, analysis, linear algebra)

### Examination

<table>
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<th>Examination</th>
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<td>Final exam of module</td>
<td>end of winter term</td>
<td>80% oral exam or written exam, 20% exercise work and presentation</td>
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### Course type

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### Total time of attendance for the module
- 0 h
# neu241 - Computational Neuroscience - Introduction

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<th>Computational Neuroscience - Introduction</th>
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<tr>
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<td>- Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<td>Kretzberg, Jutta (Authorized examiners)</td>
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<td>Greschner, Martin (Authorized examiners)</td>
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<td>Ashida, Go (Authorized examiners)</td>
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<td>Prerequisites</td>
<td>Programming experience in Matlab (e.g. acquired by a 6 ECTS programming course)</td>
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<td>Skills to be acquired in this module</td>
<td>++ Neurosci. knowlg.</td>
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<td>+ Social skills</td>
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<td>++ Interdiscipl. knowlg</td>
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<td>++ Maths/Stats/Progr.</td>
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<td>+ Data present./disc.</td>
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<td>+ Scientific English</td>
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<td>Python successful completion of this course, students</td>
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<tr>
<td></td>
<td>are able to implement and apply algorithms in Matlab</td>
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<td>have learned to handle scientific data independently</td>
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<td>have acquired theoretical and practical knowledge of advanced data analysis techniques</td>
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<td>know about computational model approaches on different levels of abstraction</td>
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<td>know how to perform model simulations for single cells and small neuronal networks</td>
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<td></td>
<td>can interpret simulation results in a neuroscientific context</td>
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## Module contents

This course consists of six weeks with different topics, which are introduced in lectures, discussed in depth using selected literature in the seminar and consolidated in computer-based hands-on exercises (in Matlab). Portfolio tasks, mainly interpretation of programming results are given every day.

- **Weeks 1 and 2:** Spike train analysis response tuning, spike triggered average, receptive fields, linear-nonlinear model, spike correlation, linear reconstruction, classification
- **Weeks 3 and 4:** Neuron models Conductance-based single cell models using differential equations (passive membrane equation, integrate and fire, Hodgkin Huxley, alpha synapses)
- **Weeks 5 and 6:** Small network models Feed-forward and feed-back networks, lateral inhibition, central pattern generator, spike-timing dependent plasticity, multi-compartment models

## Reader's advisory

- Skripts for each course day will be provided prior to / during the course
- Copies of scientific articles for the seminar and as basis for portfolio assignments will be provided prior to the course
- Recommended textbooks or other literature:

## Links

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
<td>annually</td>
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Module capacity

18

Registration procedure / selection criteria: StudIP; sequence of registration, attendance in pre-meeting

Recommended in combination with:
neu770 Neuroscientific data analysis in Matlab (prior to the course)
neu250 Computational Neuroscience - Statistical Learning (after the course)

<table>
<thead>
<tr>
<th>Modullevel / module level</th>
<th>Pflicht o. Wahlpflicht / compulsory or optional</th>
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<tbody>
<tr>
<td>Lehre/Lernform / Teaching/Learning method</td>
<td>Master of Science: Neuroscience</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Programming experience, preferably in Matlab (e.g. acquired by a 6 ECTS programming course)</td>
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<td>Final exam of module</td>
<td>during the course</td>
<td>Portfolio, consisting of daily short tests, programming exercises, short reports</td>
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<tr>
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<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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| Total time of attendance for the module | 0 h |


**bio695 - Biochemical concepts in signal transduction**

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<tr>
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**Applicability of the module**
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

**Responsible persons**
- Koch, Karl-Wilhelm (Authorized examiners)
- Scholten, Alexander (Module counselling)

**Prerequisites**
- keine

**Skills to be acquired in this module**
- ++ deepened biological expertise
- ++ deepened knowledge of biological working methods
- ++ data analysis skills
- + interdisciplinary thinking
- ++ critical and analytical thinking
- + independent searching and knowledge of scientific literature
- ++ data presentation and discussion in German and English (written and spoken)
- + teamwork
- + project and time management

**Module contents**
- Lecture: Molecular fundamentals of cellular signal processes
- Seminar: Signal transduction
- Exercises: Experiments on cellular signal transduction and enzymology

**Mechanisms of biochemical signal transduction are imparted theoretically and experimentally**

**Reader's advisory**
- Textbooks of cell biology and biochemistry. Current literature on topics of signal transduction (as announced in the preparatory meeting).

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Module frequency**
- WiSe

**Module capacity**
- 20

**Modulart / typ of module**
- Wahlpflicht / Elective

**Lehr-/Lernform / Teaching/Learning method**

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<th>Workload of compulsory attendance</th>
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<tr>
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<td>1.00</td>
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<td>Exercises</td>
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**Total time of attendance for the module**
- 0 h
# neu210 - Neurosensory Science and Behaviour

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**Applicability of the module**
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

**Responsible persons**
- Langemann, Ulrike (Module counselling)
- Hildebrandt, Jannis (Module counselling)
- Mouritsen, Henrik (Module counselling)
- Klump, Georg Martin (Authorized examiners)

**Prerequisites**
- Fundamentals of Neurobiology, Behavioural Biology, Evolution, Ecology

**Skills to be acquired in this module**
- ++ Neurosci. knowlg. + Expt. methods + Independent research + Scient. literature + Social skills
- ++ Interdiscipl. knowlg. Maths/Stats/Progr. + Data present.idisc. + Scientific English Ethics

Upon successful completion of this course, students
- know the fundamentals of behavioural ecology and neuroethology
- are able to present and critically assess scientific data and approaches

**Module contents**
The lecture "Neuroethology" provides an introduction to the mechanisms underlying the behaviour of animals. Subjects are, e.g., the mechanisms of perception, control of movement patterns, mechanisms of learning, orientation and navigation.
The lecture "Behavioural ecology" provides an introduction to topics such as predator-prey interactions, optimal food utilization, spatial and temporal distribution of animals, social relations and group formation, mating systems and reproductive strategies, sexual selection, investment of parents in offspring, and communication.
In the seminar "Current issues of Ethology", current original literature relating to behavioural biology is reported and discussed.

**Reader's advisory**

**Links**
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: 30
- Module frequency / module level: ---
- Modulart / typ of module: je nach Studiengang Pflicht oder Wahlpflicht
- Lehr-/Lernform / Teaching/Learning method

**Reference text**
Course in the second half of the semester
Regular active participation is required to pass the module.

**Examina...**

<table>
<thead>
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<th>Type of examination</th>
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<tbody>
<tr>
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<td>80% written exam (content of the two lecture series), 20% presentation(s)</td>
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<tr>
<td>Seminar</td>
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**Total time of attendance for the module**

0 h
# neu220 - Neurocognition and Psychopharmacology

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<th>Neurocognition and Psychopharmacology</th>
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<td>neu220</td>
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<td>Kreditpunkte</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>Master Biologie (Master) &gt; Background Modules</td>
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<td></td>
<td>Master Biology (Master) &gt; Background Modules</td>
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<tr>
<td></td>
<td>Master Neuroscience (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>Gießing, Carsten (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Thiel, Christiane Margarete (Modulberatung)</td>
</tr>
<tr>
<td>Teilnahmevoraussetzungen</td>
<td></td>
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<tr>
<td>Kompetenzziele</td>
<td>++ Neurosci. knowlg. + Expl. methods + Scient. literature + Social skills + Interdiscipl. knowlg. + Data present./disc. + Scientific English [nop] Upon successful completion of this course, students know the fundamentals of neurotransmission know the basic neural mechanisms underlying attention, learning, emotion, language and executive functions understand the relationship between disturbances in neurotransmitter systems, cognitive functions and psychiatric disease know the principles of drug treatment for psychiatric disorders have in-depth knowledge in selected areas of these topics are able to understand, explain and critically assess neuroscientific approaches in animals and humans are able to understand and critically assess published work in the area of cognitive neuroscience</td>
</tr>
<tr>
<td>Modulinhalte</td>
<td>The lecture &quot;Introduction to Cognitive Neuroscience&quot; gives a short introduction into neuroanatomy and cognitive neuroscience methods and then covers different cognitive functions. Lecture topics: History of cognitive neuroscience Methods of cognitive neuroscience Attention Learning Emotion Language Executive functions. The supervised excersise either deepens that knowledge by excersises or discussions of recent papers/talks on the respective topic covered during that week. The lecture &quot;Psychopharmacology&quot; illustrates the connection between neurotransmitters and behaviour and its links to psychiatric disease. The lecture contains several interactive parts to consolidate and critically evaluate the acquired knowledge. Lecture topics: Introduction to Terms and Definitions in Drug Research Dopaminergic and Noradrenergic System Cholinergic and Serotonergic System GABAergic and Glutamatergic System Addiction Depression Schizophrenia Anxiety Alzheimer's Disease</td>
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<tr>
<td>Unterrichtssprache</td>
<td>Englisch</td>
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<td>Dauer in Semestern</td>
<td>1 Semester</td>
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<tr>
<td>Angebotsrhythmus Modul</td>
<td>annually</td>
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<tr>
<td>Aufnahmekapazität Modul</td>
<td>30 (Recommended in combination with neu210 &quot;Neurosensory Science and Behaviour&quot;, neu300 &quot;Functional MRI data analysis&quot; Shared course components with (cannot be credited twice): bio610 and psy181 (5.02.614 &quot;Introduction to Cognitive Neuroscience&quot;, 5.02.615 &quot;Psychopharmacology&quot;) )</td>
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<tr>
<td>Hinweise</td>
<td>Course in the second half of the semester Regular active participation is required to pass the module.</td>
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<td>Modulart / module level</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
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</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Fundamentals of Neurobiology, Behavioural Biology</td>
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**Prüfung**

- **Prüfungszeiten**: as agreed, usually in the break after the winter term
- **Prüfungsform**: 100% written exam (content of the lectures)

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<th>Kommentar</th>
<th>SWS</th>
<th>Angebotsrhythmus</th>
<th>Workload Präsenz</th>
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<tr>
<td>Übung</td>
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**Präsenzzeit Modul insgesamt**: 0 h
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<th>Prüfungszeiten</th>
<th>Prüfungsort</th>
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<tr>
<td>Gesamtmodul</td>
<td>during the course</td>
<td>Portfolio, consisting of daily short tests, programming exercises and short reports</td>
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<table>
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<tr>
<th>Lehrveranstaltungsform</th>
<th>Kommentar</th>
<th>SWS</th>
<th>Angebotsrhythmus</th>
<th>Workload Präsenz</th>
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<tbody>
<tr>
<td>Vorlesung</td>
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<td></td>
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<tr>
<td>Übung</td>
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<td>4.00</td>
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<td></td>
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<tr>
<td>Seminar</td>
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Präsenzzeit Modul insgesamt 0 h
# neu280 - Research Techniques in Neuroscience

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<tbody>
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<td>Credit points</td>
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<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td>Responsible persons</td>
<td>Hartmann, Anna-Maria (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Nothwang, Hans Gerd (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Thiel, Christiane Margarete (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Neidhardt, John (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Greschner, Martin (Authorized examiners)</td>
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<tr>
<td></td>
<td>Bantel, Carsten (Authorized examiners)</td>
</tr>
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### Prerequisites

- Neurosci. knowlg.
- ++ Exp. Methods
- Scient. Literature
- Social skills
- Interdiscipl. knowlg.
- + Maths/Stats/Progr.
- Data present./disc.
- Scientific English
- ++ Ethics

1. have basic knowledge of different techniques (see content of the module) used in neurosciences
2. have basic knowledge of realizing clinical studies, generating questionnaires and their biostatistical data analyses
3. have acquired practical skills in whole brain imaging (fMRI) and molecular techniques
4. have acquired practical skills in performing clinical studies

### Module contents

Lecture topics:
1. Whole brain imaging (CT, MRI, fMRI, PET, EEG, MEG)
2. Animal Behaviour
3. Microscopy and Visualizing nervous system structure
4. Electrophysiology
5. Identifying Gene of Interest and Gene delivery strategies
6. Molecular Cloning, generation of transgenic organism, manipulating endogenous genes
7. Cell culture techniques
8. Biochemical assays and intracellular signalling
9. Clinical studies
10. questionnaire and biostatistics
11. judicial basics of scientific work

Laboratory course
1. molecular methods (site directed mutagenesis, PCR, midi preparation, sequencing, bioinformatics)
2. fMRI
3. clinical studies

### Reader's advisory

Guide to Research Techniques in Neuroscience, 2nd Edition
Author(s) : Carter & Shieh
Print Book ISBN : 9780128005118
eBook ISBN : 9780128005972

### Links

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: summer term / annually
- Module capacity: 20
- Registration procedure / selection criteria: StudIP
- ---
<table>
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<th>Pflicht o. Wahlpflicht / compulsory or optional</th>
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# Background Module - Summer

## neu141 - Visual Neuroscience - Physiology and Anatomy

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## Applicability of the module
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

## Responsible persons
- Greschner, Martin (Authorized examiners)
- Dedek, Karin (Authorized examiners)
- Janssen-Bienhold, Ulirike (Authorized examiners)
- Puller, Christian (Authorized examiners)

## Prerequisites
- Basic knowledge of neurobiology

## Skills to be acquired in this module
- ++ Neurosci. knowlg.
- ++ Exp. Methods
- + Independent research
- ++ Scient. Literature
- + Social skills
- + Math/Stats/Progr.
- ++ Data present./disc.
- + Scientific English
- + Ethics

Upon successful completion of this course, students
- have basic knowledge of electrophysiological techniques used in neuroscience research
- have acquired first practical skills in some electrophysiological techniques
- have acquired basic skills in data analysis
- have knowledge on retinal physiology and anatomy of the visual system
- have basic knowledge of brain structures and their function
- have profound knowledge of the architecture and circuits of the vertebrate retina
- have acquired basic skills in histological techniques (tissue fixation, embedding, sectioning, staining procedures, immunohistochemistry)
- have acquired fundamental skills in microscopy (differential interference contrast microscopy, phase-contrast microscopy, confocal microscopy)

## Module contents
The background module Neurophysiology consists of two weeks of theoretical introduction and two weeks of hands-on lab exercises in patch or extracellular recordings and two weeks of hands-on lab exercises in anatomy.

The seminars cover the following topics:
- Visual system
- Introduction to electrophysiological methods
- Introduction into methods used in neuranatomy and neurochemistry
- Introduction into microscopy and image analysis
- Presentation and discussion of results relating to the literature

## Reader's advisory
Course scripts and mandatory scientific literature discussed in the seminar will be available in Stud.IP.
Background and seminar literature will be available in Stud.IP.

## Links
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: annually, summer term, first half (full time)
- Module capacity: 12 - with Visual Neuroscience: Anatomy
Shared course components with (cannot be credited twice):
neu151 BM Visual Neuroscience: Anatomy

<table>
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<th>Modulart / typ of module</th>
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<td>Wahlpflicht / Elective</td>
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<table>
<thead>
<tr>
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<th>Basic knowledge in neurobiology</th>
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<th>Workload of compulsory attendance</th>
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<table>
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### Module - Summer

**neu150 - Visual Neuroscience - Anatomy**

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<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<tr>
<td></td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Background</td>
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<td>Modules</td>
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<tr>
<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td><strong>Responsible persons</strong></td>
<td>Dedek, Karin (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Janssen-Bienhold, Ulrike (Authorized examiners)</td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td>attendance in pre-meeting</td>
</tr>
<tr>
<td><strong>Skills to be acquired in this module</strong></td>
<td>Neurosci. knowlg. Expt. methods Independent research + Scient. literature + Social skills</td>
</tr>
<tr>
<td></td>
<td>Interdiscipl. knowlg. Maths/Stats/Progr. + Data present./disc. + Scientific English Ethics</td>
</tr>
<tr>
<td></td>
<td>Theory: Improved theoretical and methodological knowledge in neurobiology.</td>
</tr>
<tr>
<td></td>
<td>Discussion of scientific work and presentation of own results.</td>
</tr>
<tr>
<td></td>
<td>Practice: Performing neuroanatomical experiments. Gaining modern methodological skills.</td>
</tr>
<tr>
<td><strong>Module contents</strong></td>
<td>Lecture: 14 h Introduction to current neurobiological approaches and results.</td>
</tr>
<tr>
<td></td>
<td>Seminar: 14 h Discussion of background literature and results of own experiments.</td>
</tr>
<tr>
<td></td>
<td>Lab course: 3 weeks, each 24 h neuroanatomical experiments in small groups on vertebrate retina and brain.</td>
</tr>
<tr>
<td><strong>Reader's advisory</strong></td>
<td>Background and seminar literature will be available in Stud.IP</td>
</tr>
<tr>
<td><strong>Links</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Language of instruction</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Duration (semesters)</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Module frequency</strong></td>
<td>jährlich</td>
</tr>
<tr>
<td><strong>Module capacity</strong></td>
<td>unlimited</td>
</tr>
<tr>
<td><strong>Reference text</strong></td>
<td>Course in the first half of the semester</td>
</tr>
<tr>
<td></td>
<td>Regular active participation and presentation(s) within the scope of the seminar are required to pass the module</td>
</tr>
<tr>
<td><strong>Modulart / typ of module</strong></td>
<td>BC (Basiscurriculum / Base curriculum)</td>
</tr>
<tr>
<td><strong>Lehr-/Lernform / Teaching/Learning method</strong></td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
</tr>
</tbody>
</table>

### Vorkenntnisse / Previous knowledge

| **Final exam of module**         | summer semester, first half                                      |

<table>
<thead>
<tr>
<th><strong>Course type</strong></th>
<th><strong>Comment</strong></th>
<th><strong>SWS</strong></th>
<th><strong>Frequency</strong></th>
<th><strong>Workload of compulsory attendance</strong></th>
</tr>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
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<td>0</td>
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<tr>
<td>Seminar</td>
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<td>1.00</td>
<td>SuSe</td>
<td>0</td>
</tr>
<tr>
<td>Practical training</td>
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<td>3.00</td>
<td>SuSe</td>
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**Total time of attendance for the module** 0 h
<table>
<thead>
<tr>
<th>Module level / module level</th>
<th>MM (Mastermodul)</th>
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<tbody>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht</td>
</tr>
<tr>
<td><strong>Lehr-/Lernform / Teaching/Learning method</strong></td>
<td></td>
</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td></td>
<td>70% written exam, 30% presentation(s) Presentation(s) within the frame of the seminar. Regular active participation is required for the module to be passed.</td>
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<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total time of attendance for the module** 0 h
### Skills to be acquired in this module

Upon successful completion of this course, students

- have refined their programming skills (in Matlab) in order to efficiently analyze large-scale experimental data
- are able to implement a processing chain of prefiltering, statistical analysis and results visualization
- have acquired an understanding of the theoretical underpinnings of the most common statistical analysis methods and basic machine learning principles
- have practised using existing toolbox functions for complex analysis tasks
- know how to implement new analysis algorithms in software from a given mathematical formulation
- can interpret analysis results in a neuroscientific context
- have applied these techniques to both single channel and multi-channel neurophysiological data

++ Neurosci. knowlg.
+ Scient. literature
+ Social skills
++ Interdiscipl. knowlg.
++ Maths/Stats/Progr.
+ Data present./disc.
+ Scientific English

### Module contents

- data preprocessing, e.g., artifact detection and rejection, filtering, z-scoring, epoching
- data handling for high-volume data in Matlab
- introduction to relevant analysis toolbox software
- theory of multi-dimensional statistical analysis approaches, such as multi-dimensional linear regression, principal component analysis, independent component analysis, logistic regression, gradient-based optimization
- practical implementation from mathematical formulation to software code, debugging and unit testing
- postprocessing and results visualization
- consolidation during hands-on computer-based exercises (in Matlab)
- introduction to selected specialized analysis approaches during the seminar

### Reader's advisory

Wallisch et al.: MATLAB for Neuroscientists, 2nd Ed. Academic Press. More text books will be suggested prior to the course. Scientific articles: Copies of scientific articles for the seminar will be provided prior to the course

### Links

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

jährlich

**Module capacity**

18 (Recommended in combination with neu240 Computational Neuroscience - Introduction

Shared course components with (cannot be credited twice): psy220 Human Computer Interaction )

**Reference text**

Course in the first half of the semester Students without Matlab experience should take the optional Matlab course (1. week) of Computational
## Neuroscience - Introduction

<table>
<thead>
<tr>
<th>Modulelevel / module level</th>
<th>Wahlpflicht / Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulart / typ of module</td>
<td></td>
</tr>
</tbody>
</table>

### Lehr-/Lernform / Teaching/Learning method

<table>
<thead>
<tr>
<th>Vorkenntnisse / Previous knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming experience is highly recommended, preferably in Matlab</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>during the course</td>
<td>Portfolio, consisting of daily short tests, programming exercises and short reports</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>1.00</td>
<td></td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>Exercises</td>
<td>3.00</td>
<td></td>
<td>--</td>
<td>0</td>
</tr>
<tr>
<td>Seminar</td>
<td>1.00</td>
<td></td>
<td>--</td>
<td>0</td>
</tr>
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</table>

| Total time of attendance for the module | 0 h |
### neu370 - Neuroprosthetics

<table>
<thead>
<tr>
<th>Module label</th>
<th>Neuroprosthetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu370</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
</tbody>
</table>

**Applicability of the module**
- Master's Programme Neuroscience (Master) > Background Modules

**Responsible persons**
- Dietz, Mathias (Authorized examiners)
- Anna Dietze

**Prerequisites**
- Either Neurophysics (5.04.4211) or Computational Neuroscience

**Skills to be acquired in this module**
- Neurosci. knowlg.
- Expt. Methods
- Scient. Literature
- Social skills
- Interdiscipl. knowlg.
- Maths/Stats/Progr.
- Data present./disc.
- Ethics [mop] Upon successful completion of this course, students
  - understand how neuroprostheses work
  - have an interdisciplinary understanding of the underlying principles of electrical stimulation of neurons
  - can implement a coding strategy for neuroprostheses
  - knows how a cochlear implant operates in detail and why it operates this way.

**Module contents**
- Topics
  - electrical field distribution
  - electrical stimulation of neurons
  - biocompatibility
  - coding strategies
  - cochlear implants
  - student seminar presentations on various types of neuroprosthetics

**Reader's advisory**
- Scientific articles: Copies of scientific articles for the seminar will be provided prior to the course
- Text books or papers will be suggested prior to the course.

**Languages of instruction**
- Duration (semesters): 1 Semester
- Module frequency: annually (summer term)
- Module capacity: 20

**Module level / module level**
- EB (Ergänzungsbereich / Complementary)

**Lehr-/Lernform / Teaching/Learning method**
- Shared course components with (cannot be credited twice): 5.04.4216 (MSc PTM); 5.04.813 (MSc H&A)

**Vorkenntnisse / Previous knowledge**
- Programming experience in Matlab or Python

**Examination**
- Time of examination: Final exam of module
- Type of examination: PF

**Workload of compulsory attendance**

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
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</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>0</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
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**Total time of attendance for the module**
- 0 h
Please note: This module will NOT be offered anymore after summer semester 2021!

neu290 - Biophysics of Sensory Reception

<table>
<thead>
<tr>
<th>Module label</th>
<th>Biophysics of Sensory Reception</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu290</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Applicability of the module</td>
<td></td>
</tr>
<tr>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
<td></td>
</tr>
<tr>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
<td></td>
</tr>
<tr>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
<td></td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Winklhofer, Michael (Authorized examiners)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Recommended previous knowledge/skills: cell biology of neurons</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>++ Neurosci. knowlg.</td>
</tr>
<tr>
<td></td>
<td>+ Independent research</td>
</tr>
<tr>
<td></td>
<td>+ Scient. Literature</td>
</tr>
<tr>
<td></td>
<td>++ Interdiscipl. knowlg.</td>
</tr>
<tr>
<td></td>
<td>+ Data present./disc.</td>
</tr>
<tr>
<td>Module contents</td>
<td>General aspects of sensory reception and signal transduction: adequate stimulus, threshold sensitivity and signal-to-noise limitations, activation of receptor proteins Evolutionary and ecological aspects of sensory reception The senses: Chemoreception in the gustatory cells and olfactory sensory neurons Thermoreception in the skin Infrared reception in the pit organ Mechnanoreception - auditory hair cells, somatosensory neurons Proprioceptors, baroceptors Photoreception - ciliary and rhabdomeric photoreceptor cells; Electroreception in Lorenzini ampillae of elasmobranch fish and in lumbrous receptors of Mormyrid fish; derived electoreceptors in aquatic mammals Magnetoreception - candidate structural correlates of magnetoreceptors</td>
</tr>
<tr>
<td>Links</td>
<td></td>
</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Module frequency</td>
<td>annually, summer term, second half</td>
</tr>
<tr>
<td>Module capacity</td>
<td>20</td>
</tr>
<tr>
<td>Modulelevel / module level</td>
<td>MM (Mastermodul / Master module)</td>
</tr>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
</tr>
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</table>
**Lehr-/Lernform / Teaching/Learning method**

**Previous knowledge**

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>appr. one week after the last lecture</td>
<td>Type of examination: written exam (75%), presentation in the seminar (25%) In addition, mandatory but ungraded: presentation on seminar</td>
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</table>

**Course type**

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
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</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
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</table>

**Total time of attendance for the module**

<table>
<thead>
<tr>
<th></th>
<th>0 h</th>
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neu360 - Auditory Neuroscience

Module label | Auditory Neuroscience
Module code | neu360
Credit points | 6.0 KP

Applicability of the module
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Responsible persons
Klump, Georg Martin (Authorized examiners)
Köppl, Christine (Authorized examiners)

Prerequisites
Recommended previous knowledge/skills: Basics of Neurosensory Science and Behavioural Biology

Skills to be acquired in this module
++ Neurosci. knowlg
+ Expt. methods
++ Scient. Literature
+ Social skills
++ Interdiscipl. knowlg
+ Data present./disc.
++ Scientific English
+ Ethics

Introduction to Auditory Physiology. May serve as preparation for a Research Module in this area.

Upon successful completion of this course, students
- have profound knowledge on auditory sensory processing at several levels (including cochlear transduction mechanisms, central auditory processing)
- have basic knowledge of the large range of techniques used in auditory research
- are able to read and critically report to others on an original research paper in auditory neuroscience
- are able to research and review a specific topic in auditory neuroscience

Module contents
One week introductory block course, comprised of a lecture series and matching seminar that emphasizes discussion.
Topics:
- Hair cells: structure, transduction mechanism, receptor potential, synaptic transmission
- Basilar papilla / cochlea: structure, micromechanics, amplification; otoacoustic emissions
- Auditory nerve: phase locking, rate coding. Excitation patterns
- Ascending auditory pathways: wiring, principles of excitation/inhibition, examples of cellular/molecular specialisations
- Sound localisation in birds and mammals
- Central auditory processing: imaging techniques, auditory streams, cortex, primates
- Relation between psychophysics and neurophysiology

The introductory block is followed by a supervised literature search and individually written term paper on a specific topic in auditory neuroscience.

Reader's advisory
About 20 selected original papers (selection varies)
Pickles JO (2012) An Introduction to the Physiology of Hearing. Brill, Netherlands

Links
Language of instruction | English
Duration (semesters) | 1 Semester
Module frequency | annually, summer term, second half
Module capacity | 15 (BM neu211 "Neurosensory Science and Behaviour" or BM neu270 "Neurocognition and Psychophysics" or skills module biox "Current Topics in Hearing Science"

Reference text
Registration procedure / selection criteria: StudIP, final acceptance after
<table>
<thead>
<tr>
<th>Modullevel / module level</th>
<th>MM (Mastermodul / Master module)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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</table>

### Lehr-/Lernform / Teaching/Learning method

### Vorkenntnisse / Previous knowledge
Basics of Neurosensory Science and Behavioural Biology

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>within a few weeks of the end of summer term lecture period</td>
<td>HA</td>
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<table>
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<tr>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
<td>SuSe</td>
<td>0</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>1.00</td>
<td>SuSe</td>
<td>0</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
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**Total time of attendance for the module**

0 h
neu310 - Psychophysics of Hearing

Module label: Psychophysics of Hearing
Module code: neu310
Credit points: 12.0 KP

Applicability of the module:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Responsible persons:
- Klump, Georg Martin (Authorized examiners)
- Langemann, Ulrike (Authorized examiners)

Prerequisites:
- + Neurosci. knowlg.
- + Expt. Methods
- + Social skills
- ++ Maths/Stats/Progr.
- + Data present./disc.
- + Scientific English

Skills to be acquired in this module:
Students will learn the basics about performing a psychoacoustic experiment. Based on an experiment in which they study their own hearing, they will learn how to conduct a behavioural study in hearing and analyze the data. In addition, they will be be provided with an overview of the mechanisms of auditory perception.

Module contents:
The module comprises (i) a seminar “Hearing” [2 SWS] (ii) an exercise “Fundamentals in psychoacoustic data analysis” [1 SWS], and a (iii) practical course [7 SWS] including aspects of planning and conducting psychoacoustic experiments.

Reader's advisory:
Plack, Christopher J. (2005) The sense of hearing. Mahwah, NJ [u.a.]: Erlbaum (sufficient number of copies available in the university library)

Links:
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: annually, summer term, second half
- Module capacity: 6 (in total with bio640)
- Module level / module type: MM (Mastermodul / Master module)
- Lehr-/Lernform / Teaching/Learning method: Wahlpflicht / Elective

Vorkenntnisse / Previous knowledge:

Examination:
- Time of examination: end of summer term
- Type of examination: 70% report or oral exam, 30% presentation In addition, mandatory but ungraded: regular active participation

Course type:
- Exercises:
  - Comment: 1.00
  - SWS: 1.00
  - Frequency: SuSe
  - Workload of compulsory attendance: 0
- Seminar:
  - Comment: 2.00
  - SWS: 2.00
  - Frequency: SuSe
  - Workload of compulsory attendance: 0
- Practical training:
  - Comment: 5.00
  - SWS: 5.00
  - Frequency: SuSe
  - Workload of compulsory attendance: 0
- Lecture:
  - Comment: 0.00
  - SWS: 0.00
  - Frequency: SuSe
  - Workload of compulsory attendance: 0

Total time of attendance for the module: 0 h
Please note: This module will be replaced by psy270 in 2022: same topics, but only 9 ECTS!

neu300 - Functional MRI data analysis

Module label: Functional MRI data analysis
Module code: neu300
Credit points: 12.0 KP

Applicability of the module:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Responsible persons:
Gießing, Carsten (Authorized examiners)
Thiel, Christiane Margarete (Authorized examiners)

Prerequisites:
- Skills to be acquired in this module:
  - + Neurosci. knowlg.
  - ++ Expt. Methods
  - + Social skills
  - + Interdiscipl. knowlg.
  - ++ Maths/Stats/Progr.
  - + Data present./disc.
  - + Scientific English

Skills to be acquired in this module:
- Students will learn the basics about planning and performing a neuroimaging study. They will focus on the statistical and methodological background of functional neuroimaging data analysis and analyse a sample functional MRI data set.

Module contents:
The module comprises (i) a lecture "Functional MRI data analysis" [2 SWS], and (ii) a practical course [5 SWS] and (iii) a seminar "Experiments on Neurocognition" [1 SWS] including aspects of planning, performance and analysis of functional neuro-imaging studies using MATLAB based software.

Reader's advisory:

Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: annually, summer term, second half
Module capacity: 12 (in total with bio640) (shared course components with (cannot be credited twice): bio640)
Module level / module level: MM (Mastermodul / Master module)
Modulart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination Time of examination Type of examination
Final exam of module end of summer term 70% oral exam or written exam, 30% presentations
In addition, mandatory but ungraded: Regular active participation

Course type Comment SWS Frequency Workload of compulsory attendance
Practical training 5.00 SuSe 0
Seminar 1.00 SuSe 0
Lecture 2.00 SuSe 0
Total time of attendance for the module 0 h
neu340 - Invertebrate Neuroscience

Module label: Invertebrate Neuroscience
Module code: neu340
Credit points: 6.0 KP

Applicability of the module:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Responsible persons:
Kretzberg, Jutta (Authorized examiners)

Prerequisites:
attendance in pre-meeting

Skills to be acquired in this module:
- ++ Neurosci. knowlg.
- ++ Expt. Methods
- + Scient. Literature
- + Social skills
- + Math/Stats/Progr.
- + Independent Research
- + Data present./disc.
- + Scientific English
- + Ethics

Upon successful completion of this course, students will:
- have knowledge on invertebrate neuronal systems in comparison to vertebrate systems
- have discussed an overview of experimental and theoretical methods of invertebrate neuroscie
- have acquired first practical skills in intracellular recordings from invertebrate neurons
- have acquired basic skills in data analysis
- have acquired an intuitive understanding of membrane potential and action potential generation based on computer simulations

Module contents:
The module consists of three weeks of seminar and hands-on lab exercises on intracellular recordings from leech neurons, as well as computer simulations to study the basis of membrane potential and action potential generation.

The seminar covers the following topics:
- Invertebrate neuronal systems in comparison to vertebrate systems
- Ion channels, membrane potential and action potential generation
- Introduction to electrophysiological methods
- Introduction to data analysis methods

In the practical exercises, portfolio assignments will be performed on:
- Qualitative electrophysiological classification of different cell types in the leech nervous system
- Quantitative analysis (stimulus - response relationship) of at least one cell type
- Action potential generation: Comparison of model simulations and experiments
- Planning a small individual team-work project based on the techniques taught in this module, that can be used as basis for the module neu345

Reader's advisory:
Course scripts and mandatory scientific literature (3 review articles) discussed in the seminar will be available in Stud.IP Background and seminar literature will be available in Stud.IP

Links:
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: annually, summer term, second half
- Module capacity: 12
This module provides the background for neu345 "Neural Computation in invertebrate systems".

<table>
<thead>
<tr>
<th>Module level / module level</th>
<th>MM (Mastermodul / Master module)</th>
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</thead>
<tbody>
<tr>
<td>Module type / typ of module</td>
<td>Wahlpflicht / Elective</td>
</tr>
</tbody>
</table>

**Teaching/Learning method**

**Previous knowledge**

- basic knowledge of neurobiology, basic MATLAB programming skills

**Time of examination**

during the course (summer term, second half)

**Type of examination**

- Portfolio consisting of short tests, short reports (according to portfolio assignments) and seminar presentation

<table>
<thead>
<tr>
<th>Course type</th>
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<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
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**Total time of attendance for the module**

0 h
# neu345 - Neural Computation in Invertebrate Systems

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<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Responsible persons</td>
<td>Kretzberg, Jutta (Authorized examiner)</td>
</tr>
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</table>

### Prerequisites

Skills to be acquired in this module

Upon successful completion of this course, students

- have planned and conducted a small, self-defined and self-organized project in a team
- have knowledge on an invertebrate neuronal system
- have knowledge on neural coding and corresponding data analysis techniques
- have acquired skills in data analysis and / or experimental techniques and / or modeling
- are able to critically evaluate and discuss experimental results
- have prepared and presented a scientific poster

+ Neurosci. knowlg.
+ Expt. Methods
++ Independent research
+ Scient. Literature
++ Social Skills
+ Maths/Stats/Progr.
++ Data present./disc.
+ Scientific English
+ Ethics

### Module contents

This module builds up on the knowledge and methods acquired in the module neu340 Invertebrate Neuroscience.

In the seminar, the knowledge on invertebrate systems and neural coding in general is deepened based on scientific literature.

In the practical exercise of the module, students can choose one topic from a range of different research questions on computation in the leech nervous system (e.g. comparison of different cell types, electrical and chemical synaptic connections, exact measurement of spike threshold, phase locking). Small groups (2-3) of students plan, perform, and analyze experiments (intracellular recordings) or model simulations (model framework will be provided or can be self-written based on module neu241 computational neuroscience - Introduction) to tackle their topic. The portfolio consists of assignments covering the planning, analysis, interpretation, and presentation of the results with feedback given during the course on each project stage.

### Reader's advisory

Course scripts and background and seminar literature will be available in Stud.IP. Scientific literature discussed in the seminar depends on the project topics.

### Links

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency
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<td>During the course (summer term, second half)</td>
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### neu600 - Neuroscience Research Project

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<tr>
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<tr>
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**Applicability of the module**
- Master's Programme Neuroscience (Master) > Research Modules

**Responsible persons**
- der Neuroscience, Lehrende (Authorized examiners)
- Kretzberg, Jutta (Module responsibility)

**Further responsible persons**
- all MSc Neuroscience teachers, see list of examiners

**Prerequisites**
- Depending on project choice, please check Stud.IP and ask the supervisor.
- Module can be taken multiple times, however, supervision of individual projects is limited to 45 ECTS for the same combination of student and supervisor (1 research module + Master thesis OR up to 3 research modules, including external research projects)

**Skills to be acquired in this module**

- + Neurosci. knowlg.
- ++ Expt. Methods
- ++ Independent research
- ++ Scient. Literature
- + Social skills
- + Interdiscipl. knowlg.
- + Maths/Stats/Progr.
- + Data present./disc.
- + Scientific English
- + Ethics

Students perform individual research projects to learn:

- planning and organization of a research project in a group outside of University of Oldenburg
- formulate a scientific hypothesis
- planning, performing and analyzing experiments and/or simulations
- working with scientific background literature on the specific context of the project
- oral presentation and discussion of backgrounds and results in the lab seminar
- write a scientific report
- prepare and present a scientific poster

Module may serve as preparation for a Master's thesis.

**Module contents**

The Research Module is carried out under the guidance and supervision of a member of the Neuroscience faculty at the University of Oldenburg (see list of examiners). It comprises approximately 7 (minimum 5) weeks of experimental or theoretical work, individually or in small groups, and a regular seminar for training, reporting and feedback advice during that time. Students can choose between many options of individual projects, offered by the different groups involved in the MSc Neuroscience study program.

Research questions, methods and approaches differ between individual projects. Please refer to the list of options in Stud.IP and contact potential supervisors directly.

The timing of projects is by individual arrangement with the supervisor. Many,
but not all, project options can also be scheduled during semester breaks, and / or as part-time options (lasting more than 7 weeks).

Note that, for some options, priority for admission to the project is given to students who passed a background module offered by the supervisor

Participation in the Stud.IP workshop on science communication (https://elearning.uni-oldenburg.de/dispatch.php/course/overview?cid=6fc0dbbf a53d7b35e9e6b0f52ac7d0f7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended.

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<tr>
<th>Reader's advisory</th>
<th>Provided by the supervisor, depending on the project.</th>
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<tbody>
<tr>
<td><strong>Links</strong></td>
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<td><strong>Languages of instruction</strong></td>
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<td>Duration (semesters)</td>
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<tr>
<td>Module frequency</td>
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<td>Module capacity</td>
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<td>Moduleart / type of module</td>
<td>Wahlpflicht / Elective</td>
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<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Depending on selected option – please contact the supervisor</td>
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<td>Examination</td>
<td>Time of examination</td>
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<td>Final exam of module</td>
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<tr>
<td>· within 2 months after conclusion of lab work</td>
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<tr>
<td>· in addition, mandatory but ungraded: presentation at lab seminar</td>
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<td>Course type</td>
<td>Comment</td>
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<td>Project practical training</td>
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<td><strong>Total time of attendance for the module</strong></td>
<td>0 h</td>
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neu610 - External Research Project

Module label: External Research Project
Module code: neu610
Credit points: 15.0 KP

Applicability of the module: Master's Programme Neuroscience (Master) > Research Modules

Responsible persons: der Neuroscience, Lehrende (Authorized examiners)
Köppl, Christine (Module responsibility)

Further responsible persons: all MSc Neuroscience teachers, see list of examiners

Prerequisites:
A learning agreement signed by the student, the supervisor at the host institution, and the Oldenburg supervisor (from the list of examiners), needs to be submitted to the examination office prior to the start of lab work.

Module can be taken multiple times (see list of choices for each semester), however, examination of individual projects by the same supervisor is limited to EITHER two research projects (neu600 and / or neu610), OR one research project (neu600 or neu610) and the master thesis (first or second supervisor)

Skills to be acquired in this module:
- Neurosci. knowlg.
- ++ Expt. methods
- ++ Independent research
- ++ Scient. literature
- ++ Social skills
- + Interdiscipl. knowlg.
- ++ Data present./disc.
- + Scientific English
- + Ethics

Students are introduced to independent research in a specific area of neuroscience by a scientifically working group outside of the regular MSc Neuroscience faculty at the University of Oldenburg (usually a university, research institute, clinics or scientifically working company in Germany or abroad)

Students perform individual research projects to learn:
- planning and organization of a research project in a group outside of University of Oldenburg
- formulate a scientific hypothesis
- planning, performing and analyzing experiments and / or simulations
- working with scientific background literature on the specific context of the project
- oral presentation and discussion of backgrounds and results in the lab seminar
- write a scientific report
- prepare and present a scientific poster

Module contents:
The External Research Module is carried out under the guidance and supervision of an experienced researcher who is not part of the regular Neuroscience faculty at the University of Oldenburg. It comprises approximately 7 (minimum 5) weeks of experimental or theoretical work, individually or in small groups, and, usually, participation in a regular group
After completion of the lab work, students will continue to be advised during the writing phase of the project report by the external supervisor and/or by a local Neuroscience faculty member.

The timing of projects is by individual arrangement with the supervisor.

Participation in the Stud.IP workshop on science communication (https://elearning.uni-oldenburg.de/dispatch.php/course/overview?cid=6fc0dbbf53d7b3f5e3680f52ac7d0f7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended.
Skills Modules

**neu710 - Neuroscientific Data Analysis in Matlab**

<table>
<thead>
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<th>Module label</th>
<th>Neuroscientific Data Analysis in Matlab</th>
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<tr>
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<td>Credit points</td>
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<td>Master's Programme Neuroscience (Master) &gt; Skills Modules</td>
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<tr>
<td>Responsible persons</td>
<td>Kretzberg, Jutta (Authorized examiners)</td>
</tr>
</tbody>
</table>

**Prerequisites**

- + Neurosci. knowlg.
- + Social skills
- + Interdiscipl. knowlg.
- ++ Maths/Stats/Progr.
- + Scientific English
- +Ethics

Upon successful completion of this course, students

- understand basic programming concepts.
- have good knowledge about the most important aspects of the programming language Matlab and are able to write their own programs.
- have basic knowledge in statistical testing.
- have developed and applied a programs for the analysis of electrophysiological data.
- have practiced the interpretation of data analysis results in a neuroscience context

**Module contents**

In each of the seven weeks, one or two specific topics are introduced in the lecture, practiced in the exercises and applied to electrophysiological data in a programming task:

Matlab basics: Matlab windows, work space, vectors & matrices, saving & loading, graphics, scripts, functions

- Data types: numbers, logicals, text, categorical
- Control flow: if statements, loops (for, while)
- Software development: Flow charts, testing, debugging
- Working with data: Searching & sorting, logical indexing
- Advanced data types: sparse matrices, 3D matrices, cell arrays, structures, tables
- Statistics: random numbers, probability distributions, descriptive statistics, inferential statistics
- Application data analysis: Implementation of spike train analysis methods and graphics, function handles
- Application Modelling: curve fitting, simulation of time series

With completing the seven tasks, each participant develops a toolbox of the most common analysis methods for electrophysiological (spike and continuous) data. In addition to writing and commenting code, the programs are applied to experimental data. The tasks include questions about the interpretation of these analysis results.

Hence, the goal of this module is two-fold: Learning the programming language Matlab and analysis methods for electrophysiological data.

**Reader's advisory**
Pascal Wallisch: MATLAB for Neuroscientists, Elsevier, Oxford

**Links**

Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: annually, winter term
<table>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<th>Type of examination</th>
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<td>Final exam of module</td>
<td>during the course</td>
<td>practical exercise - hand in code and interpretation each week</td>
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| Total time of attendance for the module | 0 h |
### neu790 - Communicating Neuroscience

<table>
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<tr>
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<th>Communicating Neuroscience</th>
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<tbody>
<tr>
<td>Module code</td>
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### Applicability of the module
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

### Responsible persons
- Kretzberg, Jutta (Authorized examiners)
- Köppl, Christine (Authorized examiners)

### Prerequisites

#### Skills to be acquired in this module

<table>
<thead>
<tr>
<th>Skills</th>
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<tbody>
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<td>+</td>
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<tr>
<td>Scient. Literature</td>
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<td>Social skills</td>
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<td>Interdiscipl. knowlg.</td>
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<tr>
<td>Data present./disc.</td>
<td>+</td>
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<td>Scientific English</td>
<td>++</td>
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<tr>
<td>Ethics</td>
<td></td>
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</table>

Upon successful completion of this course, students will have thought about and discussed in depth scientific, social and ethical aspects of communication in and about neuroscience. In particular, participants practice critical reading of neuroscience literature, learn about the scientific publication process and discuss science communication to the general public.

### Module contents

The overall goal of critical discussion of neuroscientific results in a scientific, social and ethical context requires preparation and active participation both before (Stud.IP wiki) and during the weekly sessions. Each participant is responsible for the preparation and moderation of at least one session in a group of 2-3 students. For passing the module, additional active participation is required in at least 10 of the seminar sessions. The specific papers and topics that are discussed vary, but typically cover:

- How to find literature?
- How to read different types of scientific papers: Classic papers, review papers, perspective papers, recent original papers?
- Publication process, Authorship and impact metrics
- Alternative publication paths and data sharing in neuroscience
- Science communication for the general public and on social media
- Face-to-face scientific communication

### Reader's advisory

List of published papers, as well as online resources for preparation will be selected by the teachers and participants and announced via Stud.IP.

Background neuroscience textbooks, e.g.:

- Galizia, Lledo ‘Neuroscience – From Molecule to Behavior’, 2013, Springer
- Nicholls et al. ‘From Neuron to Brain’, 5th edition 2012, Sinauer

### Links

Related content: Science communication workshop:

https://elearning.uni-oldenburg.de/dispatch.php/course/overview?oid=6fc0dbbf53d7b3f5e3680f52ac7d0f7
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<td>Type of examination</td>
<td>Presentation (ungraded, pass / fail)</td>
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### neu751 - Laboratory Animal Science

**Module label**  
Laboratory Animal Science

**Module code**  
neu751

**Credit points**  
3.0 KP

**Applicability of the module**
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Molecular Biomedicine (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Responsible persons**
- Köppl, Christine (Authorized examiners)
- Langemann, Ulrike (Authorized examiners)
- Nolte, Arne (Authorized examiners)
- Heyers, Dominik (Authorized examiners)
- Ebbers, Lena (Authorized examiners)
- Dedek, Karin (Authorized examiners)

**Prerequisites**
none

**Skills to be acquired in this module**
++ Expt. Methods  
+ Independent Research  
+ Scient. Literature  
++ Social skills  
++ Interdiscipl. knowlg  
+ Scientific English  
++ Ethics

Upon successful completion of this course, students
- know the relevant EU legislation governing animal welfare and are able to explain its meaning in common language
- understand and are able to critically discuss salient ethical concepts in animal experimentation, such as the three Rs and humane endpoint.
- have basic knowledge of the biology and husbandry of laboratory animal species held at the University of Oldenburg (rodents or birds or fish)
- are able to critically assess the needs and welfare of animals without compromising scientific integrity of the investigation
- have practical skills in handling small rodents or birds or fish
- have profound knowledge of anaesthesia, analgesia and basic principles of surgery.
- have practised invasive procedures and euthanasia.

**Module contents**
Background knowledge is taught using the third-party online platform "LAS Interactive" which concludes with a written exam that has to be passed before the practical part. Topics covered are:
- Legislation, ethics and the 3Rs
- Scientific integrity
- Data collection
- Basic biology of rodents, birds and fish
- Husbandry, and nutrition of rodents, birds and fish
- Animal Welfare
- Health monitoring
- Pain and distress
- Euthanasia

Practical procedures will first be demonstrated, important aspects will then be practiced under supervision by every participant, on an animal model of their choice (rodents, birds or fish):
- Handling and external examination
- Administration of substances, blood sampling
- Euthanasia and dissection
- Transcardial perfusion
- Anaesthesia and surgery

NOTE: These objectives aim to satisfy the requirements for EU directive A „Persons carrying out animal experiments” and EU directive D „Persons killing animals”.

<table>
<thead>
<tr>
<th><strong>Reader's advisory</strong></th>
<th>&quot;LAS interactive&quot; internet-based learning platform</th>
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</thead>
<tbody>
<tr>
<td><strong>Links</strong></td>
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<tr>
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<tr>
<td>Duration (semesters)</td>
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<tr>
<td>Module frequency</td>
<td>semester break, every semester</td>
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<td>Modulart / typ of module</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>Vorkenntnisse / Previous knowledge</td>
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<td>Time of examination</td>
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<td>immediately before the practical part</td>
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**neu780 - Introduction to Data Analysis with Python**

<table>
<thead>
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<th>Introduction to Data Analysis with Python</th>
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<tbody>
<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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</tbody>
</table>

**Applicability of the module**
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Responsible persons**
- Winklhofer, Michael (Authorized examiners)

**Prerequisites**
- + Neurosci. knowlg.
- ++ Maths/Stats/Progr.
- + Data present./disc.

The objective of the module is the acquisition of programming skills with focus on analysis of neurobiological datasets, using the programming language python. Python is available for any computer platform (PC, Mac, Linux) and is open source (for free), see [https://www.python.org/](https://www.python.org/).

Students will learn how to write effective scripts for data processing and visualisation, making use of pre-existing program libraries for various generic purposes (maths, statistics, plotting, image analysis).

Typical applications will be analysis of time series (e.g., electrophysiological recordings, movement data), images (e.g. immunohistochemical images, MRI slices), and spatio-temporal correlations in volume data. Students will also learn how to produce synthetics data from various noise models to assess signal-to-noise ratio in instrumental datasets.

**Module contents**
- Data types and data structures, control structures, functions, modules, file input/output
- Standard libraries and SciPy libraries (Matplotlib, NumPy, ...), scikit-image, VPython, ...

**Reader's advisory**
- open access
  - [http://docs.python.org/3/tutorial/index.html](http://docs.python.org/3/tutorial/index.html)

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Module frequency**
- semester break, annually

**Module capacity**
- 20

**Reference text**
- Shared course components with (cannot be credited twice): pb328 "Einführung in Datenanalyse mit Python" (Professionalisierungsmodul im Bachelorstudiengang Biologie)

**Module level / module level**
- ---

**Modulart / typ of module**
- Wahlpflicht / Elective

**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**
- No prior knowledge in programming required, but useful.

**Examination**
- Time of examination: term break, immediately after the course (2 weeks in February)
- Type of examination: assignment of programming exercises, 4 out of 5 exercises to be assessed

**Course type** | Comment | SWS | Frequency | Workload of compulsory attendance
--- | --- | --- | --- | ---
Lecture | 2.00 | WiSe | 0
Exercises | 2.00 | WiSe | 0

**Total time of attendance for the module**
- 0 h
neu760 - Scientific English

<table>
<thead>
<tr>
<th>Module label</th>
<th>Scientific English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu760</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
</tbody>
</table>

**Applicability of the module**

- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Molecular Biomedicine (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Responsible persons**

Köppl, Christine (Module responsibility)

**Prerequisites**

non-native speakers

**Skills to be acquired in this module**

+ Neurosci. knowlg.
++ Social skills
++ Data present./disc.
++ Scientific English

Upon completion of this course, students

- have increased their proficiency in different forms of scientific presentation and communication in English, with special emphasis on neuroscience
- are able to express themselves with correct sentence structure and grammar, correct use of idioms and correct pronunciation
- are proficient in different contexts of scientific communication (e.g., paper, poster and informal exchange by email or phone)
- are able to recognize and avoid common errors of non-native speakers.

**Module contents**

Lectures cover
- characteristics of the different forms of scientific presentations
- sentence structure using the passive voice
- scientific vocabulary and terminology as contrasted to common speech
- appropriate language for communication with scientific editors and referees

Students read neuroscience texts of an advanced level and practice explaining and presenting these in both written and oral form. They also practice different contexts of scientific communication (e.g., paper, poster and informal exchange by email or phone). Emphasis is placed on individual problems in pronunciation and language use errors.

**Reader's advisory**

http://users.wpi.edu/~nab/sci_eng/ScientificEnglish.pdf

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

annually, semester break

**Module capacity**

12

**Reference text**

Usually held in the break before summer term
Outsourced to STELS-OL (Scientific and Technical English Language Service); native English speaker with in-depth neuroscience knowlg.

**Module level / module level**

je nach Studiengang Pflicht oder Wahlpflicht

**Lehr-/Lernform / Teaching/Learning method**

Vorkenntnisse / Previous knowledge

minimum English level B2 (C1 preferred) according to Common European Framework of Reference for Languages (CEFR)
priority to non-native speakers, higher semester

**Examination**

Time of examination: within 2 months of completing the course

Type of examination: Portfolio: 70% several quick tests, texts, presentations, 30% term paper
Bonus system for active participation

**Course type**

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
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<tr>
<td>Exercises</td>
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<td></td>
<td></td>
<td></td>
<td>0 h</td>
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</table>
Skills Module - Summer

neu730 - Biosciences in the Public Eye and in our Laws

<table>
<thead>
<tr>
<th>Module label</th>
<th>Biosciences in the Public Eye and in our Laws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu730</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
</tbody>
</table>

Applicability of the module

- Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Business Administration and Law (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Business Informatics (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Comparative and European Law (Bachelor) > Fachnahe Angebote Biologie more...
- Bachelor's Programme Computing Science (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Education (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Engineering Physics (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Environmental Science (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Intercultural Education and Counselling (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Physics (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Sustainability Economics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme History (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Music (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Physics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Technology (Bachelor) > Fachnahe Angebote Biologie
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Fachnahe Angebote Biologie
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Responsible persons
Köppl, Christine (Authorized examiners)
Sienknecht, Ulrike (Module counselling)

Prerequisites

Skills to be acquired in this module
+ Expt. methods
+ Scient. Literature
++ Social skills
++ Interdiscip. knowlg
+ Data present./disc.
+ Scientific English
++ Ethics

Upon completion of this course, students
- know basic rules of good scientific practise
- are aware of the legal framework that is relevant to biological research, e.g. on animal welfare or genetically modified organisms
- have practised to research and summarize different viewpoints on biological research, using both scientific (peer-reviewed) and non-scientific sources
- are able to identify and critically discuss ethical conflicts in biological research, e.g., in the context of stem cell research or data manipulation
- are able to prepare and give a coherent presentation in a team
- have practised to lead a group discussion

Module contents
In supervised exercises, students research the ethical aspects and controversial issues on several specific topics in the biosciences. Everyone participates in researching all topics. Students then take turns in summarizing and presenting each topic in small teams, and leading a critical discussion of each topic. Problem-based, independent research of the scientific background by the students is an integral part of this module.

Example topics:
Good scientific practise and fraud
Neuroenhancement
Artificial intelligence
Animal welfare, Animal experiments
Overfishing, Nature conservation
State-of-the-art genetic tools and their implications
Genetically modified organisms, e.g., in food production, chimeras
Stem cells
Humans as experimental subjects

A bonus can be obtained through active participation during the semester. Active participation requires regular oral contributions to the group discussions, that go beyond giving your own talks.
A bonus improves the exam mark by one step (0.3 or 0.4). The bonus is optional, an exam mark of 1.0 is achievable without a bonus. A bonus cannot be applied to pass a failed exam.

Reader's advisory

Links

Language of instruction English
<table>
<thead>
<tr>
<th>Duration (semesters)</th>
<th>1 Semester</th>
</tr>
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<tbody>
<tr>
<td>Module frequency</td>
<td>annually, summer term</td>
</tr>
<tr>
<td>Module capacity</td>
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<td>MM (Mastermodul / Master module)</td>
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<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Fundamentals of genetics, physiology, ecology and biological systematics</td>
</tr>
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<td>Examination</td>
<td>Time of examination</td>
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<td>Final exam of module</td>
<td>within a few weeks of summer term lecture period</td>
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<td></td>
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<tr>
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<td>Comment</td>
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<tr>
<td>Lecture</td>
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<td>Seminar and tutorial</td>
<td>4.00</td>
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<td>Total time of attendance for the module</td>
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# neu800 - Introduction to Matlab

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<tr>
<td>Module code</td>
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<td>Credit points</td>
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**Applicability of the module**
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Responsible persons**
Gießing, Carsten (Authorized examiners)

**Prerequisites**

**Skills to be acquired in this module**
- ++ Exp. Methods
- + Social skills
- + Interdiscipl. knowlg.
- ++ Maths/Stats/Progr.
- + Data present./disc.
- + Scientific English

Within this introductory course students will learn the basics of MATLAB programming. Participants will be introduced in fundamental programming concepts.

**Module contents**
The modul comprises an introduction to data structures, flow control, loops, graphics, basic data analyses with MATLAB, scripts and functions.

**Reader's advisory**

**Links**

<table>
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<th>Language of instruction</th>
<th>English</th>
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<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
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<td>12 (in total with bio640) (shared course components with (cannot be credited twice): bio640)</td>
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<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
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<tr>
<th>Final exam of module</th>
<th>end of summer term</th>
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<tbody>
<tr>
<td>Time of examination</td>
<td>Working on exercises</td>
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<td>Type of examination</td>
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**Course type**

<table>
<thead>
<tr>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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</thead>
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<tr>
<td>Lecture</td>
<td>0.00</td>
<td>SuSe</td>
<td>0</td>
<td></td>
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<tr>
<td>Seminar</td>
<td>0.00</td>
<td>SuSe</td>
<td>0</td>
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<tr>
<td>Exercises</td>
<td>2.00</td>
<td>SuSe</td>
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**Total time of attendance for the module**

0 h
### Skills Module - flexible timing

#### neu810 - International Meeting Contribution

<table>
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<th>Module label</th>
<th>International Meeting Contribution</th>
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<td>Applicability of the module</td>
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</tr>
<tr>
<td></td>
<td>Master's Programme Biology (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Kretzberg, Jutta (Authorized examiners)</td>
</tr>
<tr>
<td></td>
<td>Köppl, Christine (Authorized examiners)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td></td>
</tr>
<tr>
<td>+ Neurosci. knowlg.</td>
<td></td>
</tr>
<tr>
<td>++ Independent research</td>
<td></td>
</tr>
<tr>
<td>+ Scient. Literature</td>
<td></td>
</tr>
<tr>
<td>++ Social skills</td>
<td></td>
</tr>
<tr>
<td>+ Interdiscipl. knowlg.</td>
<td></td>
</tr>
<tr>
<td>++ Data present./disc.</td>
<td></td>
</tr>
<tr>
<td>+ Scientific English</td>
<td></td>
</tr>
<tr>
<td>+ Ethics</td>
<td></td>
</tr>
<tr>
<td>Preparation, presentation and critical discussion of own studies for an international audience:</td>
<td></td>
</tr>
<tr>
<td>• participate in an international meeting</td>
<td></td>
</tr>
<tr>
<td>• prepare a poster or talk for an international meeting</td>
<td></td>
</tr>
<tr>
<td>• present own results in a way that is appropriate for the target audience</td>
<td></td>
</tr>
<tr>
<td>• put own studies into the context of scientific literature</td>
<td></td>
</tr>
<tr>
<td>• acquire additional knowledge about a broader field of research</td>
<td></td>
</tr>
<tr>
<td>Module contents</td>
<td></td>
</tr>
<tr>
<td>Active participation in a scientific conference, workshop, summer school etc, lasting a minimum of 3 full days. Student must be the presenter (poster or talk) and an author of the presented work, typically carried out in the context of a research module or the Master thesis.</td>
<td></td>
</tr>
<tr>
<td>It is mandatory to present the poster or talk to Christine Köppl or Jutta Kretzberg prior to the meeting and incorporate the feedback on the presentation.</td>
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<tr>
<td>Reader's advisory</td>
<td>dependent on the scientific topic</td>
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<tr>
<td>Links</td>
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</tr>
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<td>Duration (semesters)</td>
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<tr>
<td>Module frequency</td>
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<td>Module capacity</td>
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<td>Modulelevel / module level</td>
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<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td></td>
</tr>
<tr>
<td>Examination</td>
<td></td>
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<tr>
<td>Time of examination</td>
<td></td>
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<tr>
<td>Type of examination</td>
<td></td>
</tr>
<tr>
<td>Final exam of module</td>
<td></td>
</tr>
<tr>
<td>Type of examination</td>
<td>presentation (ungraded, pass/fail)</td>
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<tr>
<td>Course type</td>
<td>Seminar</td>
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<tr>
<td>Frequency</td>
<td>SuSe and WiSe</td>
</tr>
</tbody>
</table>
Abschlussmodul

mam - Master Thesis

Module label: Master Thesis
Module code: mam
Credit points: 30.0 KP

Applicability of the module:
- Master's Programme Neuroscience (Master) > Abschlussmodul

Responsible persons:
der Neuroscience, Lehrende (Module responsibility)
Kretzberg, Jutta (Module responsibility)

Prerequisites:
The start of the master thesis requires prior completion of at least 60 ECTS.
Prior to the start of the thesis project, the form for application for the final thesis and final oral examination needs to be submitted to the examination office and approved by the examination committee. External examiners (not listed on the list of neuroscience examiners) need to apply for the status of an official examiner prior to the start of the project.
Depending on project choice, please ask the supervisor for additional requirements.

Skills to be acquired in this module:

++ Neurosci. knowlg.
++ Expt. Methods
++ Independent research
++ Scient. Literature
++ Social skills
+ Interdiscipl. knowlg.
+ Maths/Stats/Progr.
++ Data present./disc.
+ Scientific English
+ Ethics

In their Master thesis, students perform individual research projects in the limited time of 6 month. Learning goals:

- planning and organization of a research project
- teamwork in a research group
- formulate a scientific hypothesis
- planning, performing and analyzing experiments and / or simulations
- working with scientific background literature on the specific context of the project
- oral presentation and discussion of backgrounds and results in the lab seminar
- write a scientific report
- optional: Prepare and present a scientific poster

Module contents:
The master thesis comprises 6 months of experimental or theoretical work and thesis writing, and a regular seminar for training, reporting and feedback advice during that time. The aim, methods and results of the thesis are presented in a final oral presentation and exam (Master’s colloquium).

Students can choose between many options of individual projects, offered by
the different groups involved in the MSc Neuroscience study program. Research questions, methods and approaches differ between individual projects. The timing of projects is by individual arrangement with the supervisor. Note that, for some options, priority for admission to the project is given to students who passed a background and / or research module offered by the supervisor.

Please refer to the Stud.IP MSc Neuroscience information community forum for information on the groups and contact potential supervisors directly.

The master thesis project is generally carried out under the guidance and supervision of a member of the Neuroscience faculty at the University of Oldenburg (see list of examiners) and additionally evaluated by a second examiner. External master thesis projects and / or evaluation by persons who are not on the list of examiners need prior approval by the examination committee.

Participation in the Stud.IP workshop on science communication (https://elearning.uni-oldenburg.de/dispatch.php/course/overview?cid=6fc0dbbf a53d78f5e0f52a7dcdf7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended.

Reader's advisory

Provided by the supervisor, depending on the project.

Links

Languages of instruction
Duration (semesters) 1 Semester
Module frequency every semester
Module capacity unlimited
Modullevel / module level MM (Mastermodul / Master module)
Modulart / typ of module Pflicht / Mandatory
Lehr-/Lernform / Teaching/Learning method Individual project

Vorkenntnisse / Previous knowledge Depending on selected option – please contact the supervisor.

Examination Time of examination Type of examination
Final exam of module within 6 months after approval of the application Thesis (90%), oral presentation (10 %)

Course type Seminar

SWS 2.00

Frequency SuSe and WiSe

Workload attendance 28 h
neu725 Multivariate Statistics and Applications in R

Study program: Master of Science  
Subject: Neuroscience

Module category: Skills Module  
type: compulsory elective

Semester: winter term  
Cycle: annually

Teaching language: English  
Recommended in semester: 1 / 3

Objectives and skills taught in the module:

<table>
<thead>
<tr>
<th>Neurosci. knowlg.</th>
<th>Expt. Methods</th>
<th>+ Independent research</th>
<th>+ Scient. Literature</th>
<th>+ Social skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>++ Interdiscipl. knowlg.</td>
<td>++ Maths/Stats/Progr.</td>
<td>+ Data present./disc.</td>
<td>Scientific English</td>
<td>++ Ethics</td>
</tr>
</tbody>
</table>

Students will acquire basic knowledge in managing and understanding quantitative data and conducting a wide variety of multivariate statistical analyses. They will learn how to use the statistical methodology in terms of good scientific practice and how to interpret, evaluate and synthesize empirical results from the perspective of statistical modeling in fundamental research context. The courses in this module will additionally point out statistical misconceptions and help students to overcome them.

Module content:

Part 1: Multivariate Statistics I (lecture):
Graphical representation of multivariate data
The Generalized Linear Modeling (GLM) framework
Multiple and moderated linear regression with quantitative and qualitative predictors
Logistic regression
Multilevel regression (Generalized Linear Mixed Effects Modeling – GLMM)
Non-linear regression models
Path modeling
Factor analysis (exploratory & confirmatory)
(Multilevel) Structural equation modeling (SEM linear and non-linear)

Part 2: Analysis Methods with R (seminar)
Data examples and applications of GLM, GLMM, polynomial, spline and local regression, path modeling, factor analyses and SEM
Total credit points: 6 CP (equivalent 4 SWS, 180 hours workload)

Time frame: Weekly in winter semester

Course components and workload:

2 SWS  Lecture (VO)
  Total workload 90 h: 30 h contact / 60h self-studies & exam preparation

2 SWS  Seminar (SE)
  Total workload 90 h: 30 h contact / 60h statistical data analysis in R

SWS
  Total workload 0 h: h contact /

Type of examination: written exam
Examination period: End of winter semester
In addition, mandatory but ungraded: attendance of at least 70% in the seminars

Primary faculty responsible for the module: Prof. Dr. Andrea Hildebrandt
Additional teachers in the module:

Required reading:
Course material will be available in Stud.IP

Recommended textbook(s) or other literature:

Maximum number of students: unlimited
Registration procedure / selection criteria: Stud.IP
  Required previous credits from: none
  Recommended previous knowledge / skills:

Interrelations with other modules:
  Recommended in combination with:

Shared course components with (cannot be credited twice):
psy110 - Research methods
neu820 Neuroscience Journal Club

*Study program:* Master of Science  
*Subject:* Neuroscience  
*Module category:* Skills Module  
*Type:* compulsory elective  
*Semester:* winter term  
*Cycle:* every semester  
*Teaching language:* English  
*Recommended in semester:* 1 / 3

<table>
<thead>
<tr>
<th>Objectives and skills taught in the module:</th>
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</thead>
<tbody>
<tr>
<td>++ Neurosci. knowlg.</td>
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<tr>
<td>+ Expt. Methods</td>
</tr>
<tr>
<td>Independent research</td>
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<td>++ Scient. Literature</td>
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<tr>
<td>++ Social skills</td>
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<tr>
<td>+ Interdiscipl. knowlg.</td>
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<tr>
<td>Maths/Stats/Progr.</td>
</tr>
<tr>
<td>++ Data present./disc.</td>
</tr>
<tr>
<td>+ Scientific English</td>
</tr>
<tr>
<td>+ Ethics</td>
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</tbody>
</table>

Students will learn to read, interpret, present and discuss neuroscientific literature.

**Module content:**

Week 1: How to read and present a scientific paper and how to generate a scientific poster? Distribution of papers to participants

Week 2: Example presentation of a scientific paper by the teacher with discussion

Week 3-13: Oral presentation / moderation of discussion of one scientific paper per week by one or two student(s)

Week 14: Short poster presentations of all students

The focus topic of the scientific literature will change between semesters.

In winter semester 2021/22, the topic will be regenerative ophthalmology with the focus on tissue engineering.
Total credit points: 3 CP (equivalent 2 SWS, 90 hours workload)

Time frame: Weekly in the semester

Course components and workload:

2 SWS Seminar (SE)

<table>
<thead>
<tr>
<th>Total workload</th>
<th>SWS</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 h:</td>
<td></td>
</tr>
<tr>
<td>30 h contact /</td>
<td></td>
</tr>
<tr>
<td>60h reading</td>
<td></td>
</tr>
<tr>
<td>presentation</td>
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</table>

Type of examination: none (ungraded)

Examination period: during the semester

In addition, mandatory but ungraded: presentation, attendance of at least 70% in the seminars

Primary faculty responsible for the module: Dr. Sonja Mertsch

Additional teachers in the module:

Required reading:

Scientific literature will be available in Stud.IP

Recommended textbook(s) or other literature:

Maximum number of students: 20

Registration procedure / selection criteria: Stud.IP

Required previous credits from: none

Recommended previous knowledge / skills:

Interrelations with other modules:

Recommended in combination with:

Shared course components with (cannot be credited twice): none
### gsw200 - Microscopic Imaging in Biomedical Sciences

<table>
<thead>
<tr>
<th>Modulbezeichnung</th>
<th>Microscopic Imaging in Biomedical Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw200</td>
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<tr>
<td>Kreditpunkte</td>
<td>3.0 KP</td>
</tr>
</tbody>
</table>

### Verwendbarkeit des Moduls
- Master's Programme Molecular Biomedicine (Master) > Skills Modules

### Zuständige Personen
- Dedek, Karin (Prüfungsberechtigt)
- Groß, Petra (Prüfungsberechtigt)

### Teilnahmevoraussetzungen
- as defined in the admission and examination regulations

### Kompetenzziele
- + deepened biological expertise
- ++ deepened knowledge of biological working methods
- + data analysis skills
- ++ interdisciplinary thinking
- ++ critical and analytical thinking
- ++ data presentation and discussion (written and spoken)
- + team work

### Modulinhalte
- **Emphasis on Microscopy, Imaging, Methods of Microscopy**
- Lectures: Basics in optics, microscopy methods, image processing, biomedical applications
- Seminar: Examples for selected microscopy methods and their application
- Different microscopical methods and their applications are discussed and compared. Students will understand the basics and limitations of microscopy methods and learn to evaluate them. Selected methods are demonstrated.

### Literatureempfehlungen
- Literature will be provided during the lecture/seminar

### Links

### Unterrichtssprache
- Englisch

### Dauer in Semestern
- 1 Semester

### Angebotsrhythmus Modul
- afternoon event during winter semester
<table>
<thead>
<tr>
<th>Aufnahmekapazität Modul</th>
<th>16 (Selection criteria: attendance at first meeting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modultyp / module level</td>
<td>MM (Mastermodul / Master module)</td>
</tr>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
</tr>
<tr>
<td>Lehrlernform / Teaching/Learning method</td>
<td></td>
</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Basic physics, basic cell biology</td>
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<tr>
<td>Prüfung</td>
<td>Prüfungszeiten</td>
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<tr>
<td>Gesamtmodul</td>
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<tr>
<td>Journal presentation (40%), written examination (60 min., 60%)</td>
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<tr>
<td>Note: to qualify for the exam, regular participation during the semester is mandatory, no more than 2 days of absence</td>
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<tr>
<td>Lehrveranstaltungsform</td>
<td>Kommentar</td>
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<tr>
<td>Vorlesung</td>
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<tr>
<td>Seminar</td>
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<td>Präsenzzeit Modul insgesamt</td>
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