Background Modules

neu120 - Lab Exercises in Development and Evolution

<table>
<thead>
<tr>
<th>Module label</th>
<th>Lab Exercises in Development and Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu120</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Sienknecht, Ulrike (Module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Nothwang, Hans Gerd (Module counselling)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>required previous credits</td>
</tr>
<tr>
<td>Module contents</td>
<td>Lab exercises in comparative developmental biology on mouse and chicken embryos. Methods: in-ovo live observation; developmental stage discrimination and description, tissue preparation for histology, sectioning, staining, and microscopy</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>jährlich</td>
</tr>
<tr>
<td>Module capacity</td>
<td>unlimited</td>
</tr>
<tr>
<td>Reference text</td>
<td>Course in the first half of the semester</td>
</tr>
<tr>
<td>Modulart / module level</td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<table>
<thead>
<tr>
<th>Vorkenntnisse / Previous knowledge</th>
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</thead>
<tbody>
<tr>
<td>Examination</td>
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<tr>
<td>Final exam of module</td>
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<tr>
<td>Course type</td>
</tr>
<tr>
<td>Exercises</td>
</tr>
<tr>
<td>Seminar</td>
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<tr>
<td>Total time of attendance for the module</td>
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</table>
neu140 - Neurophysiology

Module label  Neurophysiology
Module code  neu140
Credit points  9.0 KP
Applicability of the module  
- Master's Programme Neuroscience (Master) > Background Modules
Responsible persons  
Dedek, Karin (Module counselling)
Kretzberg, Jutta (Module counselling)
Greschner, Martin (Module responsibility)
Prerequisites  
attendance in pre-meeting
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
Theory: Improved theoretical and methodological knowledge in neurobiology. Discussion of scientific work and presentation of own results.
Practice: Performing electrophysiological experiments. Gaining modern methodological skills.
Module contents  
Lecture: first week, 5*4 h introduction to current neurophysiology.
Seminar: weeks 2-4, each 4 h discussion of background literature and results of own experiments.
Lab course: weeks 2-4, each 25 h electrophysiological experiments with introduction to at least two of the techniques extracellular recording / intracellular recording / patch clamp
Reader's advisory  
Background and seminar literature will be available in Stud.IP
Links  
Language of instruction  English
Duration (semesters)  1 Semester
Module frequency  jährlich
Module capacity  unlimited
Reference text  
Course in the first half of the semester
Regular active participation and presentation(s) within the scope of the seminar are required to pass the module
Modullevel / module level  BC (Basiscurriculum / Base curriculum)
Modulart / typ of module  je nach Studiengang Pflicht oder Wahlpflicht
Lehr-/Lernform / Teaching/Learning method
Vorkenntnisse / 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>summer semester, first half</td>
<td>Portfolio consisting of short tests and short reports</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>
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<td></td>
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<tr>
<td>Seminar</td>
<td></td>
<td>1.00</td>
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<tr>
<td>Practical training</td>
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<td>WISe</td>
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Total time of attendance for the module  0 h
### neu150 - Visual Neuroscience - Anatomy

<table>
<thead>
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<th>Module label</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
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<td>Credit points</td>
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<tr>
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<td>Master's Programme Biology (Master) &gt; Background Modules</td>
</tr>
<tr>
<td></td>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
</tr>
<tr>
<td></td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
</tr>
<tr>
<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Dedek, Karin (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Janssen-Bienhold, Ulrike (Authorized examiners)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>attendance in pre-meeting</td>
</tr>
<tr>
<td>Skills to be acquired in this module</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. Discussion of scientific work and presentation of own results. Practice: Performing neuroanatomical experiments. Gaining modern methodological skills.</td>
</tr>
<tr>
<td>Module contents</td>
<td>Lecture: 14 h Introduction to current neurobiological approaches and results. Seminar: 14 h Discussion of background literature and results of own experiments. Lab course: 3 weeks, each 24 h neuroanatomical experiments in small groups on vertebrate retina and brain.</td>
</tr>
<tr>
<td>Reader's advisory</td>
<td>Background and seminar literature will be available in Stud.IP</td>
</tr>
<tr>
<td>Links</td>
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<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
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<tr>
<td>Module capacity</td>
<td>unlimited</td>
</tr>
<tr>
<td>Reference text</td>
<td>Course in the first half of the semester Regular active participation and presentation(s) within the scope of the seminar are required to pass the module</td>
</tr>
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<td>Modullevel / module level</td>
<td>BC (Basiscurriculum / Base curriculum)</td>
</tr>
<tr>
<td>Modulart / typ of module</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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### Examination

<table>
<thead>
<tr>
<th>Final exam of module</th>
<th>summer semester, first half</th>
<th>Portfolio (75 %), report (25 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course type</td>
<td>Comment</td>
<td>SWS</td>
</tr>
<tr>
<td>Lecture</td>
<td>1.00</td>
<td>SuSe</td>
</tr>
<tr>
<td>Seminar</td>
<td>1.00</td>
<td>SuSe</td>
</tr>
<tr>
<td>Practical training</td>
<td>3.00</td>
<td>SuSe</td>
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### Total time of attendance for the module

0 h
**neu170 - Molecular Genetics and Cell Biology**

<table>
<thead>
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<th>Module label</th>
<th>Molecular Genetics and Cell Biology</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu170</td>
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<tr>
<td>Credit points</td>
<td>15.0 KP</td>
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<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
</tr>
</tbody>
</table>
| Responsible persons          | Neidhardt, John (Module responsibility)  
                              | Koch, Karl-Wilhelm (Module counselling)  
                              | Thedieck, Kathrin (Module counselling) |
| Prerequisites                | + Neurosci. knowlg.  
                              | + Expt. methods  
                              | Independent research  
                              | + Scient. literature  
                              | + Social skills  
                              | ++ Interdiscipl. knowlg.  
                              | Maths/Stats/Progr. Data present./disc.  
                              | + Scientific English Ethics |
| Skills to be acquired in this module | Genetic basis of diseases, inheritance patterns of diseases and gene therapeutic approaches  
                              | Cell nucleus and genomic DNA, Nucleic acid structure and function  
                              | Signaling and Cancer  
                              | Gene expression  
                              | RNA Processing  
                              | Translation  
                              | structures of proteins and protein functions  
                              | Membranes and membran proteins  
                              | Energie metabolism in the cell  
                              | sequencing techniques and knowledge of several other selected lab techniques  
                              | Basic knowledge of how to perform research projects. |
| Module contents              | Subjects of the lecture and seminar:  
                              | + Storing and processing of genetic information  
                              | + mutation analysis  
                              | + genetic high throughput techniques  
                              | + structure and function of proteins/membranes, cytoskeleton, meta-bolic signaling, molecular basis of neurodegenerative diseases.  
                              | Exercises: Learning current methods of human genetics, cellular and molecular neurobiology; introduction to cell cultivation techniques.  
                              | + DNA extraction and agarose gel analysis  
                              | + Sanger sequencing and sequence analysis  
                              | + PCR-based techniques  
                              | + bioinformatic analysis of high throughput data  
                              | + cell culture  
                              | + gene therapy of dominant diseases |
| Reader's advisory            | Several selected scientific papers for the seminar (selection may vary)  
<pre><code>                          | Textbooks of Molecular Cell Biology; Alberts, Molecular biology of the cell |
</code></pre>
<p>| Links                        | English                           |
| Language of instruction      | English                           |
| Duration (semesters)         | 1 Semester                        |
| Module frequency             | jährlich                          |
| Module capacity              | unlimited                         |
| Reference text               | Course in the first half of the semester |</p>
<table>
<thead>
<tr>
<th>Modullevel / module level</th>
<th>MM (Mastermodul)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht</td>
</tr>
</tbody>
</table>

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

### Vorkenntnisse / Previous knowledge

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
</tr>
</thead>
</table>
| Final exam of module     | 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. |

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td></td>
<td></td>
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<tr>
<td>Exercises</td>
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<td>6.00</td>
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<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
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Total time of attendance for the module 0 h
neu190 - Biochemical concepts in signal transduction

<table>
<thead>
<tr>
<th>Module label</th>
<th>Biochemical concepts in signal transduction</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu190</td>
</tr>
<tr>
<td>Credit points</td>
<td>15.0 KP</td>
</tr>
<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
</tr>
</tbody>
</table>
| Responsible persons | Koch, Karl-Wilhelm (Module responsibility)  
                          Scholten, Alexander (Module counselling) |
| Prerequisites | Neurosci. knowlg. Expt. methods Independent research + Scient. literature + Social skills  
                          ++ Interdiscipl. knowlg. Maths/Stats/Progr. + Data present./disc. + Scientific English Ethics |
| Skills to be acquired in this module | Upon successful completion of this course, students  
                          know fundamental principles of molecular mechanisms of signal processing in cells  
                          know the properties and functional roles of proteins involved in signaling pathways  
                          have a basic understanding of structure-function relationships of receptor molecules (e.g. G-protein-coupled receptors) and their down-stream targets  
                          know the main hypotheses and their experimental confirmation in selected signal transduction pathways  
                          are able to discuss and present current concepts and knowledge of cellular signaling  
                          learn by selected experiments, how to study experimentally protein function in signaling  
                          are able to assess experimentally prepared data sets and have a good command of how to present them scientifically  
                          have a basic knowledge how to plan and perform a sequential set of experiments in molecular life sciences  
                          have a basic knowledge how to operate and use scientific equipment like spectrophotometer, fluorescence spectrophotometer, clean benches in cell culture and chromatographic systems (HPLC) |
| Module contents | Lecture on the molecular fundamentals of cellular signal processes |
| Lecture topics: | Introduction to the concept of signal transduction  
                          G protein-coupled receptors  
                          G proteins and effector molecules  
                          Biochemical properties of secondary messenger molecules  
                          Down-stream targets of secondary messengers and physiological responses  
                          Calcium and signaling networks  
                          Nitric Oxide and nitric oxide synthases  
                          Tyrosine-Kinase-receptors  
                          Signaling cascades of monomeric G proteins  
                          Molecular regulation of the cell cycle  
                          Biochemical aspects of sensory cells, their receptors and signaling pathways |
| Seminar: | Signal transduction |
| Students prepare presentations and discussions on current reviews written by leading experts in the fields; topics include: structural basis of G-protein coupled receptors, G proteins, adenylate cyclases, cyclic nucleotide research, calcium signaling, signal transduction in vision, ion channel function, nitric oxide synthase function. |
| Exercises: | Students perform experiments on cellular signal transduction and enzymology; they learn to express proteins in heterologous cell systems; they learn how to purify proteins and characterize them in subsequent assay systems. |
| Reader’s advisory | Current reviews on topics of signal transduction as preparation for the presentation in the |
Seminar; list of reviews will be adjusted every year; Textbooks of cell biology and biochemistry, Alberts et al., Molecular Biology of the Cell, 5th edition or later; Stryer, Biochemistry, 7th edition or later; these textbooks are updated almost every 3 or 4 years. Current literature on topics of signal transduction (as announced in the preparatory meeting).

Links

Language of instruction: English

Duration (semesters): 1 Semester

Module frequency: jährlich

Module capacity: unlimited

Reference text: Course in the second half of the semester
Regular active participation and seminar presentation(s) are required to pass the module.

Module level / module level: MM (Mastermodul)

Modulart / typ of module: Wahlpflicht

Lehr-/Lernform / Teaching/Learning method:

Vorkenntnisse / Previous knowledge:

Examination:

Time of examination: within 2 months after the end of the course
Type of examination: 50% written exam of 90 min., 50% report(s) Paper(s) are to be read. Regular active participation is required for the module to be passed.

Course type
Lecture
Exercises
Seminar

Comment

SWS
1.00
8.00
1.00

Frequency
WiSe
WiSe
WiSe

Workload of compulsory attendance
0
0
0

Total time of attendance for the module
0 h
### neu210 - Neurosensory Science and Behaviour

<table>
<thead>
<tr>
<th>Module label</th>
<th>Neurosensory Science and Behaviour</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu210</td>
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<tr>
<td>Credit points</td>
<td>9.0 KP</td>
</tr>
<tr>
<td>Applicability of the module</td>
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</tbody>
</table>
  - 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./disc. + 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 capacity**
30 (Recommended in combination with: neu220 BM "Neurocognition and Psychopharmacology"  
Shared course components with (cannot be credited twice): bio610 (5.02.611 "Neuroethologie", 5.02.612 "Verhaltensökologie", 5.02.613 "Aktuelle Themen der Ethologie")

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

**Modulart / module level**
---

**Modular / typ of module**
je nach Studiengang Pflicht oder Wahlpflicht

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

**Vorkenntnisse / Previous knowledge**
Fundamentals of Neurobiology, Behavioural Biology, Evolution, Ecology

**Examination**

<table>
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<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>as agreed, usually in the break after the winter term</td>
<td>80% written exam (content of the two lecture series), 20% presentation(s)</td>
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<tr>
<td>Course type</td>
<td>Comment</td>
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<td>Lecture</td>
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<tr>
<td>Seminar</td>
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<td><strong>Total time of attendance for the module</strong></td>
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# neu220 - Neurosensory Science and Behaviour - Part B

<table>
<thead>
<tr>
<th>Module label</th>
<th>Neurosensory Science and Behaviour - Part B</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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</table>

## 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 (Module counselling)

## Prerequisites

### 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

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

## Module contents

The lecture "Introduction to Cognitive Neuroscience" 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 "Psychopharmacology" 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

## Reader's advisory


## Links

### Language of instruction
- English

### Duration (semesters)
- 1 Semester

### Module frequency
- jährlich
Module capacity

30 (Recommended in combination with neu210 "Neurosensory Science and Behaviour", neu300 "Functional MRI data analysis". Shared course components with (cannot be credited twice): bio610 and psy181 (5.02.614 "Introduction to Cognitive Neuroscience", 5.02.615 "Psychopharmacology")

Reference text

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

Modullevel / module level

Course in the second half of the semester

Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

Lehr-/Lernform / Teaching/Learning method

Fundamentals of Neurobiology, Behavioural Biology

Vorkenntnisse / Previous knowledge

Fundamentals of Neurobiology, Behavioural Biology

Examination

Time of examination

Type of examination

Final exam of module

as agreed, usually in the break after the winter term
100% written exam (content of the lectures)

<table>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
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<td>Exercises</td>
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<td>1.00</td>
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Total time of attendance for the module

0 h
### neu240 - Computational Neuroscience - Introduction

<table>
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<th>Computational Neuroscience - Introduction</th>
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<tbody>
<tr>
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<td>Credit points</td>
<td>9.0 KP</td>
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<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Kretzberg, Jutta (Module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Greschner, Martin (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Hildebrandt, Jannis (Module counselling)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>attendance in pre-meeting</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Neurosci. knowlg. Expt. methods Independent research + Scient. literature + Social skills Interdiscipl. knowlg. ++ Maths/Stats/Progr. + Data present./disc. + Scientific English Ethics Upon successful completion of this course, students have acquired good programming skills (in Matlab) are able to implement and apply algorithms have learned to handle scientific data independently have acquired theoretical and practical knowledge of advanced data analysis techniques know about computational model approaches on different levels of abstraction know how to perform model simulations for single cells and small neuronal networks can interpret simulation results in a neuroscientific context</td>
</tr>
<tr>
<td>Module contents</td>
<td>This course consists of four 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. Week 1: Background and Matlab preparation week practice of programming principles (functions,scripts, if, loops, structures, cell arrays) revision of neuroscience backgrounds (neuron, membrane, spike) Week 2: Spike train analysis response tuning, spike triggered average, receptive fields, linear-nonlinear model, spike correlation, linear reconstruction, classification Week 3: Neuron models Conductance-based single cell models using differential equations (passive membrane equation, integrate and fire, Hodgkin Huxley, alpha synapses) Week 4: Network models small networks (lateral inhibition, central pattern generator) larger networks (integrate and fire networks, rate models, inhibition-excitation balance, learning)</td>
</tr>
<tr>
<td>Reader's advisory</td>
<td>Dayan / Abbott: Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. MIT Press (More text books will be suggested prior to the course). Scripts for each course day will be provided prior to / during the course Copies of scientific articles for the seminar will be provided prior to the course</td>
</tr>
<tr>
<td>Links</td>
<td>Dayan / Abbott: Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. MIT Press (More text books will be suggested prior to the course). Scripts for each course day will be provided prior to / during the course Copies of scientific articles for the seminar will be provided prior to the course</td>
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<td>Language of instruction</td>
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<td>Duration (semesters)</td>
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<tr>
<td>Module capacity</td>
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<tr>
<td>Modulelevel / module level</td>
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<td>Time of examination</td>
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<td>Type of examination</td>
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<table>
<thead>
<tr>
<th>Examination</th>
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<td>Portfolio, consisting of daily short tests, programming exercises and short reports</td>
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<table>
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<tr>
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<td>Exercises</td>
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<tr>
<td>Seminar</td>
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**Total time of attendance for the module** 0 h
### neu250 - Computational Neuroscience - Statistical Learning

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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>
</tr>
<tr>
<td>Responsible persons</td>
<td>Rieger, Jochem (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Anemüller, Jörn (Module counselling)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>attendance in pre-meeting</td>
</tr>
</tbody>
</table>

**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>Modullevel / module level</th>
<th>Wahlpflicht / Elective</th>
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<tr>
<td>Modulart / typ of module</td>
<td></td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
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<td>Vorkenntnisse / Previous knowledge</td>
<td>Programming experience is highly recommended, preferably in Matlab</td>
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<th>Type of examination</th>
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<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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<th>SWS</th>
<th>Frequency</th>
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| Total time of attendance for the module | 0 h |
**neu270 - Neurocognition & Psychophysics**

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

**Responsible persons**
- Klump, Georg Martin (Module responsibility)
- Thiel, Christiane Margarete (Module counselling)
- Langemann, Ulrike (Module counselling)
- Gießing, Carsten (Module counselling)

**Prerequisites**
- 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

**The aim of the module is the study of different aspects of psychophysics or neurocognition. Students participate in ongoing projects and gain a first insight into topical research.**

**Module contents**
- Students have the choice of two basic streams:
  - Stream 1: “Neurocognition” comprises (i) an exercise “Introduction to MATLAB” [2 SWS], (ii) a lecture “Functional MRI data analysis” [2 SWS], and (iii) a practical course [5 SWS] and a seminar “Experiments on Neurocognition” [1 SWS] including aspects of planning, performance and analysis of functional neuro-imaging studies using MATLAB based software.
  - Stream 2 “Psychophysics of Hearing” comprises (i) exercise “Introduction to MATLAB”, (ii) lecture and seminar “The sense of hearing”, and (iii) a laboratory project in which psychoacoustical experiments into the function of the auditory system are performed.

**Reader's advisory**

**Links**
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Reference text: Course in the second half of the semester
- Regular active participation is required to pass the module

**Modulelevel / module level**: MM (Mastermodul)

**Modulart / typ of module**: Wahlpflicht

**Vorkenntnisse / Previous knowledge**
- Examination: Time of examination: end of summer term
- Type of examination: 70% report or oral exam or written exam, 30% presentation (talk or poster)

**Time of examination**
- Lecture: 2.00 SWS
- Exercises: 2.00 SWS
- Practical training: 6.00 SWS

**Workload of compulsory attendance**

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

Module label: Computational Neuroscience - Introduction
Module code: neu241
Credit points: 12.0 KP
Applicability of the module: Master's Programme Neuroscience (Master) > Background Modules
Responsible persons:
- Kretzberg, Jutta (Authorized examiners)
- Greschner, Martin (Authorized examiners)
- Ashida, Go (Authorized examiners)
Prerequisites: Programming experience in Matlab (e.g. acquired by a 6 ECTS programming course)
Skills to be acquired in this module:
++ Neurosci. knowlg.
++ Interdiscipl. knowlg
++ Maths/Stats/Progr.
+ Data present./disc.
+ Scient. Literature
+ Social skills
+ Signed exam

Upon successful completion of this course, students
- are able to implement and apply algorithms in Matlab
- have learned to handle scientific data independently
- have acquired theoretical and practical knowledge of advanced data analysis techniques
- know about computational model approaches on different levels of abstraction
- know how to perform model simulations for single cells and small neuronal networks
- can interpret simulation results in a neuroscientific context

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
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: annually
**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)

**Modullevel / module level**

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

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

**Vorkenntnisse / Previous knowledge**
Programming experience, preferably in Matlab (e.g. acquired by a 6 ECTS programming course)

**Examination**

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<th>Type of examination</th>
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<tbody>
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<td>Final exam of module</td>
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<td>Portfolio, consisting of daily short tests, programming exercises, short reports</td>
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**Course type**

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

0 h
neu280 - Research Techniques in Neuroscience

Module label: Research Techniques in Neuroscience
Module code: neu280
Credit points: 6.0 KP

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

Responsible persons:
Hartmann, Anna-Maria (Authorized examiners)
Nothwang, Hans Gerd (Authorized examiners)
Thiel, Christiane Margarete (Authorized examiners)
Neidhardt, John (Authorized examiners)
Greschner, Martin (Authorized examiners)
Bantel, Carsten (Authorized examiners)

Prerequisites:
- Skills to be acquired in this module:
  + Neurosci. knowlg.
  ++ Expt. 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)
  2. have basic knowledge of realizing clinical studies, generating questionaires
     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, IMRI, 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. IMRI
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

Modullevel / module level: ---
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<th>Pflicht o. Wahlpflicht / compulsory or optional</th>
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# neu290 - Biophysics of Sensory Reception

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<td><a href="#">Master's Programme Neuroscience (Master) &gt; Background Modules</a></td>
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<tr>
<td>Responsible persons</td>
<td>Winklhofer, Michael (Authorized examiners)</td>
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<td>Prerequisites</td>
<td>Recommended previous knowledge/skills: cell biology of neurons</td>
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<td>Skills to be acquired in this module</td>
<td>++ Neurosci. knowlg.</td>
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<tr>
<td></td>
<td>+ Independent research</td>
</tr>
<tr>
<td></td>
<td>+ Scient. Literature</td>
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<tr>
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<td>++ Interdiscipl. knowlg.</td>
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<tr>
<td></td>
<td>+ Data present./disc.</td>
</tr>
<tr>
<td></td>
<td>to gain a general understanding of sensory reception</td>
</tr>
<tr>
<td></td>
<td>to acquire specific knowledge of sensory reception at the molecular and cellular level,</td>
</tr>
<tr>
<td></td>
<td>with focus on the relationship between structure and function of sensory molecules</td>
</tr>
<tr>
<td></td>
<td>to be able to perform simple quantitative assessments of detection sensitivity to physical stimuli</td>
</tr>
<tr>
<td></td>
<td>to understand common features in transduction pathways among various senses</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 Mechanoreception - auditory hair cells, somatosensory neurons in the skin, lateral line, proprioceptors, baroceptors Photoreception - ciliary and rhabdomeric photoreceptor cells; Electroreception in Lorenzini ampullae of elasmobranch fish and in tuberous receptors of mormyrid fish; derived electroreceptors in aquatic mammals Magnetoreception - candidate structural correlates of magnetoreceptors</td>
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<td>MM (Mastermodul / Master module)</td>
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### Lehr-/Lernform / Teaching/Learning method

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### Examination

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<th>Time of examination</th>
<th>Type of examination</th>
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<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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### Course type

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<th>Comment</th>
<th>SWS</th>
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**Total time of attendance for the module**: 0 h
# neu300 - Functional MRI data analysis

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<th>Functional MRI data analysis</th>
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<tr>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<table>
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<tr>
<th>Responsible persons</th>
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</thead>
<tbody>
<tr>
<td>Gießing, Carsten (Authorized examiners)</td>
</tr>
<tr>
<td>Thiel, Christiane Margarete (Authorized examiners)</td>
</tr>
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</table>

## Prerequisites

Skills to be acquired in this module

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

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

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<th>SWS</th>
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## Total time of attendance for the module

0 h
**neu305 - Essentials of fMRI Data Analysis with SPM and FSL**

<table>
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</tbody>
</table>
| Responsible persons | Weerda, Riklef (Authorized examiners)  
Sörös, Peter (Authorized examiners)  
Weerda, Riklef (Module responsibility) |

**Prerequisites**

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

This module offers a concise introduction to the basic principles of functional magnetic resonance imaging (fMRI). Students will gain essential knowledge about experimental design, data collection and analysis. Special emphasis will be laid on the statistical background of fMRI data analysis and a hands-on introduction to SPM and FSL, two widely-used and free software packages for fMRI data analysis and results visualisation.

**Module contents**

1. Methodological basics of functional magnetic resonance imaging (fMRI)
2. Basic principles of fMRI experimental design and data collection
3. Statistical background of fMRI data analysis
4. Hands-on training in fMRI data analysis and results visualisation with SPM and FSL

**Reader’s advisory**

Recommended textbook(s) or other literature:

**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
<td>annually, winter term, first half</td>
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<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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**Vorkenntnisse / Teaching/Learning method**

Recommended previous knowledge / skills: statistics, MATLAB

**Examination**

- **Final exam of module**: December
- **Time of examination**: written exam (multiple choice) In addition, mandatory but ungraded: continuous active participation

**Course type** | **Comment** | **SWS** | **Frequency** | **Workload of compulsory attendance** |
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<td>0.00</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

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

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 modul 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)
Modullevel / 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% report or oral exam, 30% presentation In addition, mandatory but ungraded: regular active participation

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

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 stochastics, 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, Dallibard (Eds.): Methods and Models in Neurophysics (2003)
- Galizia, Lledo (Eds.): Neurosciences, from molecule to behauvor (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)
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<th>Reference text</th>
<th>Recommended in combination with: 5.04.4012 Informationsverarbeitung und Kommunikation (phy350) Will also be offered in &quot;M.Sc. Physik, Technik, Medizin&quot;</th>
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<td>Pflicht o. Wahlpflicht / compulsory or optional</td>
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<td>Lehr-/Lernform / Teaching/Learning method</td>
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<td>Vorkenntnisse / Previous knowledge</td>
<td>Computer programming (preferably Matlab), basic mathematics (statistics, analysis, linear algebra)</td>
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<tr>
<td>Examination</td>
<td>Time of examination</td>
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bio605 - Molecular Genetics and Cell Biology

**Module label**: Molecular Genetics and Cell Biology  
**Module code**: bio605  
**Credit points**: 12.0 KP  

**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/

**Language of instruction**  
English

**Duration (semesters)**  
1 Semester

**Module frequency**

**Module capacity**  
15

**Reference text**  
associated with bio900

**Modullevel / module level**  
MM (Mastermodul / Master module)

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

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

**Examination**

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<td>written examination (70 %), paper(s) presentation 30 %; not graded: signed lab protocols, regular active participation is required for the module to be passed.</td>
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**Course type**

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**Total time of attendance for the module**

0 h
bio695 - Biochemical concepts in signal transduction

Module label: Biochemical concepts in signal transduction
Module code: bio695
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 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).

Links:
Language of instruction: English
Duration (semesters): 1 Semester

Module frequency:
20

Modullevel / module level:
MM (Mastermodul / Master module)

Modulart / typ of module:
Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method:

Vorkenntnisse / Previous knowledge:

Examination:

Type of examination:
written examination (50%)
protocols (50%)

Final exam of module:
90 minutes written exam

Course type:
Lecture
Seminar
Exercises

Comment:

SWS
1.00
1.00
6.00

Frequency:
WiSe
WiSe
WiSe

Workload of compulsory attendance:
0
0
0

Total time of attendance for the module:
0 h

30 / 84
**bio845 - Introduction to Development and Evolution**

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<tr>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<tr>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td>Responsible persons</td>
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<tr>
<td>Sienknecht, Ulrike (Module responsibility)</td>
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<td>Claußen, Maike (Authorized examiners)</td>
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<tr>
<td>Prerequisites</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>Upon successful completion of this course, students</td>
</tr>
<tr>
<td>- know the fundamental problems organisms share in development</td>
<td></td>
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<tr>
<td>- know the common basic steps of ontogenesis after comparing the life cycles of different species (both vertebrates and invertebrates)</td>
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<tr>
<td>- know the fundamentals of the genetic control of cell-fate specification, morphogenesis, and organogenesis</td>
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<tr>
<td>- know the principles of gene regulatory networks in development and are able to explain examples</td>
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<tr>
<td>- are able to explain and discuss mechanisms of development across taxonomic groups and questions about the evolution of developmental mechanisms</td>
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<tr>
<td>- have in-depth knowledge of the development of animal nervous systems, including cellular and net-work properties</td>
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<tr>
<td>skills:</td>
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<tr>
<td>++ deepened biological expertise</td>
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<tr>
<td>+ deepened knowledge of biological working methods</td>
<td></td>
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<tr>
<td>++ interdisciplinary thinking</td>
<td></td>
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<td>++ critical and analytical thinking</td>
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<tr>
<td>+ independent searching and knowledge of scientific literature</td>
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<tr>
<td>+ ability to perform independent biological research</td>
<td></td>
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<tr>
<td>+ teamwork</td>
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</table>

**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

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

**Module capacity**

20 (selection criteria: sequence of registration)

**Reference text**

associated with bio846 (previously neu120) (Lab Exercises in Development and Evolution)

**Modullevel / module level**

MM (Mastermodul / Master module)

**Modulart / typ of module**

Wahlpflicht / Elective

**Vorkenntnisse / Previous knowledge**

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

**Examination**

**Time of examination**

same winter term

**Type of examination**

oral exam of 30 minutes (or written exam*) *Pending approval PO

**Course type**

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**Total time of attendance for the module**

90 h
# bio846 - Lab Exercises in Development and Evolution

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</table>

## 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
Language of instruction English
Duration (semesters) 1 Semester
Module frequency
Module capacity 6 (selection criteria: sequence of registration)
Reference text Associated with bio845 (previously neu110) (Introduction to Development and Evolution)
Modullevel / module level MM (Mastermodul / Master module)
Modulart / typ of module Wahlpflicht / Elective
Lehr-/Lernform / Teaching/Learning method
Vorkenntnisse / Previous knowledge organismic biology, experience with lab work
Examination Time of examination Type of examination
Final exam of module same winter term 1 report
Course type Exercises

SWS 6.00
Frequency WiSe
Workload attendance 84 h
**neu141 - Visual Neuroscience - Physiology and Anatomy**

<table>
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<td>Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
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<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td>Responsible persons</td>
<td>Greschner, Martin (Authorized examiners)</td>
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<td>Janssen-Bienhold, Ulrike (Authorized examiners)</td>
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<td>Puller, Christian (Authorized examiners)</td>
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<tr>
<td>Prerequisites</td>
<td>Basic knowledge of neurobiology</td>
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<td>Skills to be acquired in this module</td>
<td>++ Neurosci. knowlg.</td>
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<tr>
<td></td>
<td>+ Independent research</td>
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<td>++ Scient. Literature</td>
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<td>++ Data present./disc.</td>
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<tr>
<td></td>
<td>+ Scientific English</td>
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<td>+ Ethics</td>
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</table>

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**

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Shared course components with (cannot be credited twice):
neu151 BM Visual Neuroscience: Anatomy

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<td>Wahlplicht / Elective</td>
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**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**
Basic knowledge in neurobiology

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<td>In addition, mandatory but ungraded: seminar presentation</td>
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<td>2.00</td>
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**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
+ Maths/Stats/Progr.
+ Independent Research
+ Data present./disc.
+ Scientific English
+ Ethics

Upon successful completion of this course, students
- have knowledge on invertebrate neuronal systems in comparison to vertebrate systems
- have discussed an overview of experimental and theoretical methods of invertebrate neuroscience
- 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"

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**Total time of attendance for the module**

0 h
**neu345 - Neural Computation in Invertebrate Systems**

**Module label**  
Neural Computation in Invertebrate Systems

**Module code**  
neu345

**Credit points**  
6.0 KP

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

**Responsible persons**  
Kretzberg, Jutta (Authorized examiners)

**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**

39 / 84
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<td>Portfolio consisting of project plan, scientific poster, poster presentation</td>
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neu350 - Biological Foundations of Neuroscience

Module label | Biological Foundations of Neuroscience
Module code | neu350
Credit points | 6.0 KP

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

Responsible persons
- Puller, Christian (Authorized examiners)
- Neidhardt, John (Authorized examiners)
- Koch, Karl-Wilhelm (Authorized examiners)
- Hartmann, Anna-Maria (Authorized examiners)
- Greschner, Martin (Authorized examiners)
- Klump, Georg Martin (Authorized examiners)
- Owczarek-Lipska, Marta (Authorized examiners)

Prerequisites
- Recommended in combination with "Research Techniques in Neuroscience"

Skills to be acquired in this module
- 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.

++ Neurosci. knowlg.
+ Scient. Literature
+ Social skills
+ Interdiscipl. knowlg.
+ Scientific English

Module contents
- The background module consists of a lecture series and an associated seminar.
- The following topics are covered:
  - Biochemistry
  - Genetics
  - Electrophysiology
  - Cell biology
  - Systems Neuroscience

Reader's advisory
- Neuroscience, newest edition; Purves; Sinauer Associates
- Stryer Biochemistry and Alberts et al. Molecular Biology of the Cell, several editions
- Molecular Biology of the Gene, Watson (Pearson Verlag)

Links

Languages of instruction

Duration (semesters) | 1 Semester
Module frequency | annually
Module capacity | unlimited

Module level / module level | MM (Mastermodul / Master module)
Moduleart / typ of module | Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination | Time of examination | Type of examination
Final exam of module | at the end of the course | KL

Course type | Comment | SWS | Frequency | Workload of compulsory attendance
Lecture | | 2.00 | SuSe or WiSe | 0
Seminar | | 2.00 | SuSe or WiSe | 0

Total time of attendance for the module | 0 h
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
+ Expl. 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
assignment of seminar presentation

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

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

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

**Module label**: Neuroprosthetics

**Module code**: neu370

**Credit points**: 6.0 KP

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

**Responsible persons**
Dietz, Mathias (Authorized examiners)

**Further responsible persons**
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 [nop]
  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**
- electrical field distribution
- electrical stimulation of neurons
- biocompatibility
- coding strategies
- cochlear implants
- student seminar presentations on various types of neuroprothetics

**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.

**Links**

**Languages of instruction**

**Duration (semesters)**
1 Semester

**Module frequency**
annually (summer term)

**Module capacity**
20

**Modullevel / module level**
EB (Ergänzungsbereich / Complementary)

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

**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**
**Type of examination**

**Final exam of module**
PF

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**Total time of attendance for the module**
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## Research Modules

### neu410 - Auditory Neuroscience

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**Applicability of the module**

- Master's Programme Neuroscience (Master) > Research Modules

**Responsible persons**

- Klump, Georg Martin (Module counselling)
- Hildebrandt, Jannis (Module counselling)
- Köppl, Christine (Module responsibility)

**Prerequisites**

**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

Introduction to independent, experimental research in auditory sensory physiology. May serve as preparation for a Master thesis.

- Upon successful completion of this course, students
  - have profound knowledge on auditory sensory processing, including cochlear transduction mechanisms, central auditory processing and auditory psychophysics
  - 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
  - have in-depth knowledge on a specific research question in auditory neuroscience
  - are able to discuss current hypotheses and controversies regarding their research question
  - are able to perform experiments addressing their research topic and can describe the principles and the pros and cons of the experimental technique used
  - are able to critically evaluate and discuss experimental results

**Module contents**

One week introductory block course "Fundamentals of Auditory Physiology", 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 course is followed by 6 weeks of small-group laboratory-based projects, participating in the supervisor's ongoing research. This includes experimental work, data analysis, literature study, participation in the group seminar and in a poster presentation of concurrent Research Modules. There are three options for the lab projects:

- Option 1: Cochlea and auditory brainstem (Köppl)
- Option 2: Auditory cortex (Hildebrandt)
- Option 3: Central auditory mechanisms (Klump)

**Reader's advisory**

About 20 selected original papers (selection varies)


**Links**

**Language of instruction**

- English

**Duration (semesters)**

- 1 Semester

**Module frequency**

- jährlich
## Module capacity
unlimited

## Reference text
Introductory block course will be held in the first week of winter term, lab component is flexible and subject to individual arrangement. Participation in a joint poster presentation of concurrent research modules is required to pass the module.

## Modullevel / module level
---

## Modulart / typ of module
je nach Studiengang Pflicht oder Wahlpflicht

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

#### Vorkenntnisse / Previous knowledge

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**neu440 - Visual Neuroscience**

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<td>Master's Programme Neuroscience (Master) &gt; Research Modules</td>
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<tr>
<td>Responsible persons</td>
<td>Janssen-Bienhold, Ulrike (Module responsibility) Dedek, Karin (Module counselling) Greschner, Martin (Module counselling)</td>
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<tr>
<td>Prerequisites</td>
<td>attendance in pre-meeting, priority is given to students who attended neu140 BM Neurophysiology and / or neu150 BM Neuroanatomy</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>+ Neurosci. knowlg. Expt. methods Independent research Scient. literature + Social skills Interdiscipl. knowlg. + Maths/Stats/Progr. Data present./disc. + Scientific English + Ethics + During the module the students acquire advanced theoretical knowledge of the molecular and cellular characteristics of retinal circuits and physiology. + Students learn to plan and perform a research project independently (includes: literature research and usage of data banks (PUBMED, Gene Bank, Expasy etc.) + Students are introduced to scientific writing / have to write a scientific report. + Students acquire advanced skills in data analysis (including statistics, computational neuroscience, image analysis) + The module can serve the purpose of preparing for a Master's thesis.</td>
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<tr>
<td>Module contents</td>
<td>1. Independent performance of an individual research project in small groups. Dates are individually arranged with the respective supervisor. Available project topics will be presented in the pre-meeting. Methods include: Option 1: Molecular Neuroscience Option 2: Neuroanatomy Option 3: Neurophysiology 2. Participation in the &quot;Journal club&quot; seminar, including presentation of the project and the results obtained.</td>
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<td>Reference text</td>
<td>Regular active participation and presentation(s) within the scope of the seminar are required to pass the module. Furthermore, participation in a joint poster presentation of concurrent research modules is required to pass the module.</td>
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<td>Modullevel / module level</td>
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<td>Time of examination</td>
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**Total time of attendance for the module**

0 h
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<td><strong>Responsible persons</strong></td>
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<tr>
<td><strong>Prerequisites</strong></td>
</tr>
<tr>
<td><strong>Skills to be acquired in this module</strong></td>
</tr>
<tr>
<td><strong>Module contents</strong></td>
</tr>
<tr>
<td><strong>Reader's advisory</strong></td>
</tr>
<tr>
<td><strong>Links</strong></td>
</tr>
<tr>
<td><strong>Languages of instruction</strong></td>
</tr>
<tr>
<td><strong>Duration (semesters)</strong></td>
</tr>
<tr>
<td><strong>Module frequency</strong></td>
</tr>
<tr>
<td><strong>Module capacity</strong></td>
</tr>
<tr>
<td><strong>Reference text</strong></td>
</tr>
<tr>
<td><strong>Modullevel / module level</strong></td>
</tr>
<tr>
<td>Modulart / typ of module</td>
</tr>
<tr>
<td>--------------------------</td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
</tr>
<tr>
<td>Examination</td>
</tr>
<tr>
<td>Final exam of module</td>
</tr>
<tr>
<td>Participation in seminar, Signed project report</td>
</tr>
<tr>
<td>Course type</td>
</tr>
<tr>
<td>SWS</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Workload attendance</td>
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</table>
neu510 - Computation in Sensory Systems

Module label | Computation in Sensory Systems
---|---
Module code | neu510
Credit points | 15.0 KP
Applicability of the module | Master's Programme Neuroscience (Master) > Research Modules

Responsible persons
- Kretzberg, Jutta (Module responsibility)
- Greschner, Martin (Module counselling)
- Hildebrandt, Jannis (Module counselling)
- Rieger, Jochem (Module counselling)

Prerequisites
- attendance in pre-meeting, priority is given to students who attended BM Computational Neuroscience

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, 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 can serve as preparation for a Master's thesis.

Module contents
Students can choose between five options (explained in more detail during the pre-meeting):
1. invertebrate somatosensory system (Kretzberg)
2. vertebrate visual system (Greschner)
3. vertebrate auditory system (Hildebrandt)
4. human perception-action cycle (Rieger)
5. advanced analysis of physiological data (Anemüller)

In options 1-4, depending on the student's interests and background, projects can be focussed on
- experiments (neurophysiology / behavior)
- simulation
- data analysis or
- combinations of these approaches

In all systems, project can be focussed on experiments (neurophysiology / behavior), simulation, data analysis or combinations of these approaches.

Reader's advisory | Will be given to the students depending on the project

Language of instruction | English
Duration (semesters) | 1 Semester
Module frequency | halbjährlich
Module capacity | unlimited

Reference text
The timing of individual projects can be discussed with the supervisor. Projects can also be scheduled during semester breaks, part-time options (lasting more than 7 weeks) are available.

- priority for admission to the module is given to students who passed computational neuroscience background modules (neu240 / neu250)

- Participation in a joint poster presentation of concurrent research
modules is highly recommended.

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<thead>
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<tbody>
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<td>Modulart / typ of module</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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**Lehr-/Lernform / Teaching/Learning method**

**Vorkenntnisse / Previous knowledge**

<table>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>flexible, 6 weeks after individual project</td>
<td>Internship report</td>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Seminar</td>
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<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project-oriented module</td>
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<td>9.00</td>
<td>WiSe</td>
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**Total time of attendance for the module**

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### neu540 - Neural Basis of Perception

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<tr>
<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Research Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Klump, Georg Martin (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Mouritsen, Henrik (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Winklhofer, Michael (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Kretzberg, Jutta (Module responsibility)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>attendance in pre-meeting, priority is given to students who attended at least one of the background modules listed as &quot;recommended in combination with&quot;</td>
</tr>
<tr>
<td></td>
<td>Students perform individual research projects to learn:</td>
</tr>
<tr>
<td></td>
<td>• planning, performing and analyzing experiments and / or simulations</td>
</tr>
<tr>
<td></td>
<td>• working with scientific background literature on the specific context of the project</td>
</tr>
<tr>
<td></td>
<td>• oral presentation and discussion of backgrounds and results in the lab seminar</td>
</tr>
<tr>
<td></td>
<td>• write a scientific report</td>
</tr>
<tr>
<td></td>
<td>• prepare and present a scientific poster</td>
</tr>
<tr>
<td>Module contents</td>
<td>Introductory lecture and seminar (either blocked or parallel to lab work) plus 6 weeks of small-group lab projects, participating in the supervisor's ongoing research, and in the respective group seminar. There are four options for the lab projects:</td>
</tr>
<tr>
<td></td>
<td>Option 1: Navigation mechanisms in nocturnal bird migration (Mouritsen) comprises (i) lecture &quot;Bird migration&quot;, (ii) participation in group seminar, and (iii) a laboratory project &quot;Navigation mechanisms in nocturnal bird migration&quot; (flexible timing); including participation in investigations of navigation mechanisms in migratory birds (project focussing on behavioural biology, molecular biology or neuroanatomy).</td>
</tr>
<tr>
<td></td>
<td>Option 2: Invertebrate somatosensory system (Kretzberg), includes participation in group seminar, journal club and laboratory project (all flexible timing).</td>
</tr>
<tr>
<td></td>
<td>Option 3: Central auditory mechanisms (Klump), includes introductory block course &quot;Fundamentals of Auditory Physiology&quot; (one week at start of winter semester) , participation in group seminar and a laboratory project (flexible timing)</td>
</tr>
<tr>
<td></td>
<td>Option 4: Magnetic field perception (Winklhofer), includes participation in group seminar, journal club and laboratory project (all flexible timing).</td>
</tr>
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<td>Links</td>
<td>Language of instruction English</td>
</tr>
<tr>
<td></td>
<td>Duration (semesters) 1 Semester</td>
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<tr>
<td>Module frequency</td>
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<td>------------------</td>
<td>----------</td>
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<tr>
<td>Module capacity</td>
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</table>

**Reference text**

- Please note that different options have mandatory course components at different times.
- Priority for admission is given to students who attended at least one of the background modules listed as "recommended in combination with"

- Participation in a joint poster presentation of concurrent research modules is highly recommended.

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>Modulart / typ of module</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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</table>

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

**Vorkenntnisse / Previous knowledge**

**Examination** | Time of examination | Type of examination |
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<tr>
<th></th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>within 2 months after completion of experimental work</td>
<td>Internship report</td>
</tr>
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</table>

**Course type** | **Comment** | **SWS** | **Frequency** | **Workload of compulsory attendance** |
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
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</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>1.00</td>
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<td></td>
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<tr>
<td>Project-oriented module</td>
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<td>8.00</td>
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**Total time of attendance for the module** | 0 h
# neu570 - Development and Evolution of the Auditory System

<table>
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<th>Module label</th>
<th>Development and Evolution of the Auditory System</th>
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<tbody>
<tr>
<td>Module code</td>
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<td>Applicability of the module</td>
<td>Master's Programme Neuroscience (Master) &gt; Research Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Nothwang, Hans Gerd (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Köppl, Christine (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>Sienknecht, Ulrike (Module responsibility)</td>
</tr>
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</table>

## Prerequisites

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

Introduction to experimental research in the field of development and evolution of the auditory system.

## Module contents

Two-week introductory course into current research questions and techniques of the field; followed by 5 weeks of small-group lab projects, participating in the supervisor's ongoing research, and in the group seminar. There are several options for the lab projects, in the broad categories of:

1. Molecular development and evolution of the peripheral auditory system (Sienknecht)
2. Molecular development and evolution of the central auditory system (Nothwang)
3. Comparative studies of the peripheral or central auditory system (Köppl)
4. Regenerative medicine of the auditory system (Löwenheim, Müller)

## Reader's advisory

Springer Handbook of Auditory Research (SHAR); Sanes et al. eds. Development of the Nervous System, Academic Press; and research papers (original papers and reviews)

## Links

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Reference text: Course in the second half of the semester usually in winter term; lab component is flexible and subject to individual arrangement. Participation in a joint poster presentation of concurrent research modules is required to pass the module.

## Modullevel / module level

---

## Modulart / typ of module

je nach Studiengang Pflicht oder Wahlpflicht

## Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

<table>
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<tr>
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<tbody>
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<td>Final exam of module</td>
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<td>Portfolio: 60% presentation, 40% internship report (paper or poster format)</td>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Seminar</td>
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<td>1.00</td>
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<tr>
<td>Project-oriented module</td>
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<td>9.00</td>
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## Total time of attendance for the module

0 h
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
seminar during that time.

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=6fc0dcbf5a5347b39f8e3689f2e2a70d7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended.

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<th>Provided by external and / or local supervisor, depending on the project</th>
</tr>
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<tbody>
<tr>
<td>Links</td>
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<td>Language of instruction</td>
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<tr>
<td>Duration (semesters)</td>
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</tr>
<tr>
<td>Module frequency</td>
<td>every semester</td>
</tr>
<tr>
<td>Module capacity</td>
<td>unlimited (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) )</td>
</tr>
<tr>
<td>Reference text</td>
<td>All teachers from the list of MSc Neuroscience examiners at the University of Oldenburg can act as examiners, students should contact appropriate supervisors individually Prior to project start, external and local supervisors must fill the learning agreement form. The supervisor at the host institution is invited to submit a short, written statement of assessment, final grading is done by the supervisor from the list of examiners.</td>
</tr>
<tr>
<td>Modullevel / module level</td>
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<td>Wahlpflicht / Elective</td>
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<td>Vorkenntnisse / Previous knowledge</td>
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<td>Time of examination</td>
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<td>Type of examination</td>
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**neu600 - Neuroscience Research Project**

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<tr>
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<td>Credit points</td>
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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 a53d7b3f5e3680f52ac7d0f7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended.

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<th>Provided by the supervisor, depending on the project.</th>
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<table>
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<tr>
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<tr>
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<td>Modullevel / module level</td>
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<td>Modulart / typ of module</td>
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<td>Vorkenntnisse / Previous knowledge</td>
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</thead>
<tbody>
<tr>
<td>Exam</td>
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<tr>
<td>Final exam of module</td>
</tr>
<tr>
<td>• within 2 months after conclusion of lab work</td>
</tr>
<tr>
<td>• in addition, mandatory but ungraded: presentation at lab seminar</td>
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<table>
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<th>Comment</th>
<th>SWS</th>
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<tbody>
<tr>
<td>Project practical training</td>
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<td>8.00</td>
<td>SuSe or WiSe</td>
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<tr>
<td>Seminar</td>
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<td>2.00</td>
<td>SuSe or WiSe</td>
<td>0</td>
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| Total time of attendance for the module | 0 h |
Skills Modules

neu710 - Neuroscientific Data Analysis in Matlab

Module label | Neuroscientific Data Analysis in Matlab
---|---
Module code | neu710
Credit points | 6.0 KP

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

Responsible persons
Kretzberg, Jutta (Authorized examiners)

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

Skills to be acquired in this module
- 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 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
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<th>Module capacity</th>
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<td>Modulart / typ of module</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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<td>Vorkenntnisse / Previous knowledge</td>
<td>basic knowledge of math and statistics</td>
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<tr>
<td>Examination</td>
<td>Time of examination</td>
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<td>during the course</td>
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<td>Exercises</td>
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neu720 - Statistical programming in R

<table>
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<tr>
<td>Applicability of the module</td>
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<td>Master's Programme Biology (Master) &gt; Skills Modules</td>
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<tr>
<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td>Responsible persons</td>
<td>Otto-Sobotka, Fabian (Authorized examiners)</td>
</tr>
<tr>
<td>Prerequisites</td>
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</table>

**Skills to be acquired in this module**

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

- students learn the use of the software R in application scenarios
- students learn to actively "speak" the programming language R
- students practice statistical data analysis with R

**Module contents**

The lecture gives an intuitive introduction into the use of the statistics software R. We start by introducing the basic handling of R and the syntax of its programming language. We use those to obtain the first statistical analyses from R. The next important step is to create informative graphics to represent the statistical results. Finally, we look into programming concepts that allow for more complex statistical analyses.

**Reader's advisory**

R Core Team - R: A language and environment for statistical computing (Reference Manual)

**Links**

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

annually, summer term

**Module capacity**

24

**Reference text**

Recommended previous knowledge / skills: basic statistical knowledge including regression analysis

**Modullevel / module level**

---

**Modulart / typ of module**

Wahlpflicht / Elective

**Vorkenntnisse / Previous knowledge**

**Examination**

Time of examination: practical exercise

**Type of examination**

Final exam of module

after the course

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**Total time of attendance for the module**

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## neu730 - Biosciences in the Public Eye and in our Laws

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**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
- 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
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- 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

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

**Prerequisites**

Skills to be acquired in this module
- Expt. methods
- Scient. Literature
  - Social skills
  - Interdiscipl. 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
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<th>Duration (semesters)</th>
<th>1 Semester</th>
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<td>Module frequency</td>
<td>annually, summer term</td>
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<tr>
<td>Module capacity</td>
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<td>Module level/module level</td>
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<tr>
<td>Module art/typ of module</td>
<td>Wahlpflicht / Elective</td>
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</table>

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

| Vorkenntnisse / Previous knowledge | Fundamentals of genetics, physiology, ecology and biological systematics |

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<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td>within a few weeks of summer term lecture period</td>
<td>Term paper Regular participation during the semester is required (max 3 days of absence)</td>
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<td>Seminar and tutorial</td>
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**Total time of attendance for the module**

0 h
neu740 - Molecular Mechanisms of Ageing

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### 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
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- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Biologie
In this module the participants gain an overview of arguments and experimental strategies in ageing research. We will focus on the fields of medicine/epidemiology, biochemistry/ cell biology, physiology, and genetics. In addition, the main ageing theories will be covered. The participants work throughout the semester in project groups and present their results at a conference at the end of the course. Ethicists and philosophers from Germany and The Netherlands accompany the course, and chair at the conference a session on ethical aspects of ageing research. Under their moderation, the participants derive joint standpoints and policy recommendations. At the end of this course the participants can

understand, analyse, and present scientific articles from ageing research

present the results of their studies and analyses using different presentation techniques

apply the learned contents in novel contexts (ethics in ageing research)

Topics

Major ageing theories

arguments and experimental strategies in the fields of medicine/epidemiology, biochemistry/ cell biology, physiology, genetics in ageing research

application of the learned contents in novel contexts (ethics in ageing research) understanding, analysing, and presentation of scientific articles

presentation of results with different presentation techniques

Module contents

Lecture: major ageing theories and methods in ageing research are presented and discussed Exercise: project work

1) Students: Choice of research focus
2) Independent work on the chosen research paper
3) Writing a 1 page thesis paper
4) Presentation in own expert group
5) Expert groups: research strategies, approaches, methods in chosen focus area
6) Development of a group presentation and group poster
7) Presentation at 1 day conference
8) Dutch and German ethics experts present bioethics and lobby work in German and Dutch political gremia

9) The students develop a comparative view on medical ethics in different countries and derive own standpoints and policy recommendations for the ethical assessment of metabolic and ageing research. The project work runs independently in the different expert groups throughout the semester and is organised via StudIP. The students and groups receive regular feedback and guidance in presence meetings.

The days for presence meetings and final conference are determined with the participants during the first meeting. The students organize their own work in groups according to the jigsaw concept. Their work is structured by a weekly schedule, tasks to be handed in at fixed deadlines across the semester, lectures and presence meetings.

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Reader's advisory

Primary and secondary literature will be provided and introduced at the first meeting

Recommended textbook(s) or other literature:
Roger B. McDonald, Biology of Aging, Garland Science
Altern : Zelluläre und molekulare Grundlagen, körperliche Veränderungen und Erkrankungen, Therapieansätze
Ludger Rensing ; Volkhard Rippe

Links

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
annually, summer term

Module capacity
16

Modullevel / module level
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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 semester
portfolio: thesis paper, oral presentation, poster presentation In addition, mandatory but ungraded: questionnaire on ageing theories, meeting protocols

Course type
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2.00
SuSe
0

Exercises
4.00
SuSe
0

Total time of attendance for the module
0 h
neu750 - Laboratory Animal Science

Module label: Laboratory Animal Science
Module code: neu750
Credit points: 6.0 KP

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

Responsible persons:
- Langemann, Ulrike (Module counselling)
- Klump, Georg Martin (Module counselling)
- Nolte, Arne (Module counselling)
- Gerlach, Gabriele (Module counselling)
- Köppl, Christine (Module responsibility)

Prerequisites:

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

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 and birds)
- 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 and birds
- have profound knowledge of anaesthesia, analgesia and basic principles of surgery.
- have practised invasive procedures and euthanasia.

NOTE: These objectives aim to satisfy the requirements for EU directive A „Persons carrying out animal experiments“ and EU directive D „Persons killing animals“ for rodents, birds and fish. We aim to obtain accreditation by the Federation of European Laboratory Animal Science Associations (FeLaSa) by mid-2017.

Module contents:

Background knowledge on:
- 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:
- Handling and external examination of mouse, gerbil, zebra finch, chicken, zebra fish
- Administration of substances, blood sampling
- Euthanasia and dissection
- Transcardial perfusion
- Anaesthesia and surgery

Reader's advisory:
"LAS interactive" internet-based learning platform
Wolfensohn and Lloyd (2013) Handbook of Laboratory Animal Management
<table>
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<tbody>
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<td>Vorkenntnisse / Previous knowledge</td>
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<td>Written exam of 90 min.</td>
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<tr>
<td>Exercises</td>
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| Total time of attendance for the module | 0 h |
neu760 - Scientific English

Module label: Scientific English
Module code: neu760
Credit points: 6.0 KP

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

Links:

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.

Modullevel / module level:
je nach Studiengang Pflicht oder Wahlpflicht

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: SWS: Frequency: Workload of compulsory attendance:
Lecture: 0.50: WiSe: 0
Exercises: 3.50: WiSe: 0
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<td>72 / 84</td>
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# neu770 - Basics of Statistical Data Analysis

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<tr>
<td>Module code</td>
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<td>Credit points</td>
<td>6.0 KP</td>
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## Applicability of the module
- Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Aufbaumodule
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

## Responsible persons
Otto-Sobotka, Fabian (Authorized examiners)

## Prerequisites
- Social skills
- Interdiscipl. knowl.
- Maths/Stats/Progr.
- Scientific English

## Skills to be acquired in this module
- Upon successful completion of this course, students have basic statistical competencies for understanding data.
- Understand the main statistical methods and their practical use through application.
- Can evaluate statistical methods regarding the qualities and their limits.

## Module contents
- Populations and samples; exploratory data analysis through describing statistics.
- Elementary probabilities and random variables.
- Important discrete and continuous distributions.
- Estimating parameters through the method of maximum likelihood.
- Confidence intervals and classical significance testing.
- Pairs of random variables; distribution and dependence.
- Classical regression analysis.
- Basic use of the software R to apply those methods.

## Reader's advisory
Will be available in Stud.IP

## Links
Language of instruction: English

## Duration (semesters)
1 Semester

## Module frequency
Annually, winter term

## Module capacity
Unlimited

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

## Vorkenntnisse / Previous knowledge
Basic mathematical knowledge; use of probabilities recommended in combination with neu720 Statistical programming with R

## Examination
- Final exam of module: after the course, written exam, 2h

## Course type
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<td>Seminar</td>
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## Total time of attendance for the module
0 h
# neu780 - Introduction to Data Analysis with Python

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<thead>
<tr>
<th>Module label</th>
<th>Introduction to Data Analysis with Python</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu780</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 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.

**Skills to be acquired in this module**
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 synthetica 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

**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Module frequency</td>
<td>semester break, annually</td>
</tr>
<tr>
<td>Module capacity</td>
<td>20</td>
</tr>
</tbody>
</table>

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

**Teaching/Learning method**
Wahlpflicht / Elective

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

<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>term break, immediately after the course (2 weeks in February)</td>
<td>assignment of programming exercises, 4 out of 5 exercises to be assessed</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>WiSe</td>
<td>0</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>WiSe</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total time of attendance for the module**
0 h
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 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.

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

**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
**Reader's advisory**

"LAS interactive" internet-based learning platform

**Links**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
<td>semester break, every semester</td>
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<tr>
<td>Module capacity</td>
<td>10 (Registration procedure / selection criteria: StudIP, sequence of registration)</td>
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</table>

**Modullevel / module level**

| Modulart / typ of module | je nach Studiengang Pflicht oder Wahlpflicht |

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

**Vorkenntnisse / Previous knowledge**

<table>
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<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
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<td>written exam of 90 minutes</td>
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**Course type**

<table>
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<th>SuSe and WiSe</th>
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<tbody>
<tr>
<td>Exercises</td>
<td>1.00</td>
<td>SuSe and WiSe</td>
<td>0</td>
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**Total time of attendance for the module**

0 h
# neu790 - Communicating Neuroscience

<table>
<thead>
<tr>
<th>Module label</th>
<th>Communicating Neuroscience</th>
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<tbody>
<tr>
<td>Module code</td>
<td>neu790</td>
</tr>
<tr>
<td>Credit points</td>
<td>3.0 KP</td>
</tr>
</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
- Kretzberg, Jutta (Authorized examiners)
- Köppl, Christine (Authorized examiners)

## Prerequisites

### Skills to be acquired in this module
- **Neurosci. knowlg.**
- **Scient. Literature**
- **Social skills**
- **Interdiscipl. knowlg.**
- **Data present./disc.**
- **Scientific English**
- **Ethics**

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?cid=6fc0dbbf0a53d7b5f5e3680f52ac7d07
<table>
<thead>
<tr>
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</thead>
<tbody>
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<tr>
<td><strong>Module frequency</strong></td>
<td>winter semester</td>
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<td><strong>Module capacity</strong></td>
<td>20 (Registration procedure / selection criteria: StudIP)</td>
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<tr>
<td><strong>Modullevel / module level</strong></td>
<td>MM (Mastermodul / Master module)</td>
</tr>
<tr>
<td><strong>Modulart / typ of module</strong></td>
<td>Wahlpflicht / Elective</td>
</tr>
<tr>
<td><strong>Lehr-/Lernform / Teaching/Learning method</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Vorkenntnisse / Previous knowledge</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td><strong>Time of examination</strong></td>
</tr>
<tr>
<td><strong>Final exam of module</strong></td>
<td><strong>Type of examination</strong></td>
</tr>
<tr>
<td><strong>Course type</strong></td>
<td>Seminar</td>
</tr>
<tr>
<td><strong>SWS</strong></td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>WiSe</td>
</tr>
<tr>
<td><strong>Workload attendance</strong></td>
<td>28 h</td>
</tr>
</tbody>
</table>
Within this introductory course students will learn the basics of MATLAB programming. Participants will be introduced in fundamental programming concepts.

Within this introductory course students will learn the basics of MATLAB programming. Participants will be introduced in fundamental programming concepts.
.neu810 - International Meeting Contribution

<table>
<thead>
<tr>
<th>Module label</th>
<th>International Meeting Contribution</th>
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<tbody>
<tr>
<td>Module code</td>
<td>neu810</td>
</tr>
<tr>
<td>Credit points</td>
<td>3.0 KP</td>
</tr>
<tr>
<td>Applicability of the module</td>
<td>Master's Programme Biology (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td></td>
<td>Master's Programme Biology (Master) &gt; Skills Modules</td>
</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>
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<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>++ Social skills</td>
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<td>+ Interdiscipl. knowlg.</td>
</tr>
<tr>
<td></td>
<td>++ Data present./disc.</td>
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<td></td>
<td>+ Scientific English</td>
</tr>
<tr>
<td></td>
<td>+ Ethics</td>
</tr>
<tr>
<td>Preparation, presentation and critical discussion of own studies for an international audience:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• participate in an international meeting</td>
</tr>
<tr>
<td></td>
<td>• prepare a poster or talk for an international meeting</td>
</tr>
<tr>
<td></td>
<td>• present own results in a way that is appropriate for the target audience</td>
</tr>
<tr>
<td></td>
<td>• put own studies into the context of scientific literature</td>
</tr>
<tr>
<td></td>
<td>• acquire additional knowledge about a broader field of research</td>
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</table>

**Module contents**

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.

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.

**Reader's advisory**

dependent on the scientific topic

**Links**

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
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<tbody>
<tr>
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<tr>
<td>Module frequency</td>
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<tr>
<td>Module capacity</td>
<td>unlimited (please contact module organizer individually)</td>
</tr>
<tr>
<td>Modullevel / module level</td>
<td>MM (Mastermodul / Master module)</td>
</tr>
<tr>
<td>Modulart / typ of module</td>
<td>Wahlpflicht / Elective</td>
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</table>

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

**Vorkenntnisse / 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>presentation (ungraded, pass/fail)</td>
<td></td>
</tr>
</tbody>
</table>

**Course type**

Seminar

**SWS**

2.00

**Frequency**

SuSe and WiSe
| Workload attendance | 28 h |
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=6fc0dbbf453d7b3f3e3680f52ac7c7d0f7) and a poster presentation at the biology & neuroscience student poster symposium is not mandatory but highly recommended. Provided by the supervisor, depending on the project. 

<table>
<thead>
<tr>
<th>Reader's advisory</th>
<th>Provided by the supervisor, depending on the project.</th>
</tr>
</thead>
</table>

| Links |  
|---|---|
| Languages of instruction |  
| Duration (semesters) | 1 Semester  
| Module frequency | every semester  
| Module capacity | unlimited  
| Module level / module level | MM (Mastermodul / Master module)  
| Module type / type of module | Pflicht / Mandatory  
| Lehr-/Lernform / Teaching/Learning method | Individual project  
| Vorkenntnisse / Previous knowledge | Depending on selected option – please contact the supervisor.  

<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>within 6 months after approval of the application</td>
<td>Thesis (90%), oral presentation (10 %)</td>
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<table>
<thead>
<tr>
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<th>Seminar</th>
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</thead>
<tbody>
<tr>
<td>SWS</td>
<td>2.00</td>
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