### Modules for Biology

#### Background Modules

**bio703 - Basic Concepts in Plant Sciences**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Basic Concepts in Plant Sciences</th>
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<tbody>
<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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</table>
  - Master's Programme Biology (Master) > Background Modules  
  - Master's Programme Biology (Master) > Background Modules |

**Contact person**

- Module responsibility
  - Dirk Carl Albach
- Authorized examiners
  - Dirk Carl Albach
  - Gerhard Wolfgang Zotz
  - Sascha Laubinger
  - Klaus Bernhard von Hagen
- Module counseling
  - Gerhard Wolfgang Zotz
  - Sascha Laubinger
  - Klaus Bernhard von Hagen

**Entry requirements**

**Skills to be acquired in this module**

- Communicating deeper knowledge in ecology, phylogeny, evolution and genetics of plants
- Communicating scale- and method-overarching thinking
- Communicating deeper theoretic concepts of ecology, evolution and genetics of plants
  - ++ 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
  - + ability to perform independent biological research
  - ++ data presentation and discussion in German and English (written and spoken)
  - + teamwork
  - ++ ethics and professional behaviour

**Module contents**

- V: Biodiversity of plants (2 SWS)
- V: Resource acquisition and use by plants (1 SWS)
- V: Gene expression in plants (1 SWS)
- S: Phylogeny of plants (2 SWS)
- S: Interactions of plants with environmental parameters (2SWS)

**Reader's advisory**


**Links**

**Languages of instruction**  
German, English

**Duration (semesters)**  
1 Semester

**Module frequency**  

**Module capacity**  
12

**Reference text**  
associated with bio765 (Current Methods in Plant Science) (recommended)

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

**Modulart**  
Wahlpflicht / Elective

**Lern- / Lehrform / Type of program**  

**Vorkenntnisse / Previous knowledge**  
Ökologie, Flora, Genetik

**Examination**  

**Time of examination**  

**Final exam of module**  
1 Portfolio (40%), 1 report (60%)
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<td>WiSe</td>
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**Total time of attendance for the module** 112 h
# bio765 - Current Methods in Plant Sciences - Ecology, Phylogeny and Molecular Biology

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<th>Current Methods in Plant Sciences - Ecology, Phylogeny and Molecular Biology</th>
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<td></td>
<td>• Sascha Laubinger</td>
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<td>• Sascha Laubinger</td>
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<td>• Dirk Carl Albach</td>
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<td>• Dirk Carl Albach</td>
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<td>• Gerhard Wolfgang Zotz</td>
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<td>Acquaintance and practicing ecological, phylogenetic and molecular methods</td>
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<td>Communication of scale- and method-overarching thinking and project planning</td>
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<td>Capacity for teamwork, project- and time management</td>
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<td>• independent searching and knowledge of scientific literature</td>
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<td>• data presentation and discussion in German and English (written and spoken)</td>
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<td>• teamwork</td>
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bio655 - Ornithology

Module label: Ornithology
Module code: bio655
Credit points: 12.0 KP
Workload: 360 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules

Contact person

Module responsibility
- Franz Bairlein

Authorized examiners
- Georg Martin Klump
- Sandra Bouwhuis
- Christine Köppl
- Ulrike Langemann
- Henrik Mouritsen
- Heiko Schmaljohann
- Franz Bairlein

Module counseling
- Georg Martin Klump
- Sandra Bouwhuis
- Christine Köppl
- Ulrike Langemann
- Henrik Mouritsen
- Heiko Schmaljohann
- Franz Bairlein

Entry requirements

Skills to be acquired in this module
- The module imparts advanced knowledge on different aspects of ornithology. The students acquire:
  - An extended knowledge of morphological and physiological fundamentals and the resulting ecological and behaviour-biological consequences in birds
  - Knowledge, presentation and discussion of relevant English literature from various fields of ornithology
  - Deepened biological expertise
  - Deepened knowledge of biological working methods
  - Critical and analytical thinking
  - Independent searching and knowledge of scientific literature
  - Data presentation and discussion in German and English (written and spoken)

Module contents

The module is composed of the lecture "Ecology and Physiology of Birds", a seminar accompanying the lecture "Current Questions of Ornithology", a seminar "Behavioural Ecology of Birds", and a seminar "Methods in Field Ornithology".

Lecture "Ecology and Physiology of Birds":
This lecture consolidates special aspects of systematics, morphology, physiology, migration, orientation, population biology, communication and behavioural ecology in birds.

Seminar "Current Questions of Ornithology":
In this seminar, original English publications are presented and discussed which deal with current research results from various fields treated in the lecture. Every student reads a paper on one scientific article and discusses the results of that article with the other participants.

Seminar "Behavioural Ecology of Birds" (option 1):
In the seminar, current literature relating to the life history of birds will be reported. During the term, each participant is presenting an original paper in a short talk and the group of students will be guided to critically discuss the paper.

Seminar "Methods in Field Ornithology" (option 2):
The core methods of field ornithology, such as stable isotopes, bird census, ringing, radar, radio tracking, etc., will be introduced with the help of English scientific papers by the students. In the presentations the corresponding methods will be explained in detail with an emphasis on the pros and cons of the method. The aim of this seminar is to learn how to deal with scientific methods in a critical way.

Reader's advisory

bio770 - Field Methods in Organismal Biology

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Contact person

- Module responsibility
  - Gerhard Wolfgang Zotz

- Authorized examiners
  - Gerhard Wolfgang Zotz
  - Gabriele Gerlach
  - Dirk Carl Albach
  - Thomas Glatzel
  - Klaus Bernhard von Hagen
  - Henrik Mouritsen

- Module counseling
  - Gabriele Gerlach
  - Dirk Carl Albach
  - Thomas Glatzel
  - Klaus Bernhard von Hagen
  - Henrik Mouritsen

Entry requirements

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
++ ability to perform independent biological research
+ data presentation and discussion in German and English (written and spoken)
++ project and time management
++ statistics & scientific programming

The module aims at enabling students to apply theoretical knowledge to practical, hypothesis-based field studies within the scope of a seminar. The data derived from the individual projects performed are then to be documented and discussed in the form of a written laboratory course report oriented by a scientific publication and to be written in English. Several teachers cooperate to enable interdisciplinary approaches (e.g. botanical-zoological approaches).

Module contents

S: Biogeographic and ecological classification and characterization of a biome (e.g. Mediterranean region, moist tropics, boreal zone), independent identification and treatment of scientific questions, presentation of scientific results in a “mini symposium” subsequent to the field studies.

E: Planning and performing a field study project, data analysis, written report in the form of a scientific publication

Reader's advisory

Varies with topic and field locality

Links

www.uni-oldenburg.de/fun_eco/

Languages of instruction

German, English

Duration (semesters)

1 Semester

Module frequency

jährlich

Module capacity

21

Modullevel

MM (Mastermodul / Master module)

Modulart

Wahlpflicht / Elective

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

Time of examination

Type of examination

Final exam of module

Presentation(s) (30 %)
Laboratory course report on project work (70 %)

Course type

Comment

SWS

Frequency

Workload attendance
<table>
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**Total time of attendance for the module**  168 h
### bio720 - Marine Biodiversity

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**Contact person**
- Module responsibility
  - Pedro Miguel Martinez Arbizu
- Authorized examiners
  - Pedro Miguel Martinez Arbizu
  - Thomas Glatzel
- Module counseling
  - Thomas Glatzel

**Entry requirements**
- BSc (Biology)

**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**
- **++ ability to perform independent biological research**
- **++ data presentation and discussion in German and English (written and spoken)**
- **++ teamwork**
- **++ ethics and professional behaviour**
- **++ project and time management**
- **++ statistics & scientific programming**

Knowledge of fundamentals, topical subjects and methods in Marine Biology and Marine Geology. Studies and critical assessment of the scientific literature.

**Module contents**
- L: (AW) General Marine Geology
- E: Biogenic sedimentation, Interaction benthos-sediment; (SS) Plankton of the oceans; (MH) unicellular plankton; (IK) benthos of the North-Sea; (PM) biodiversity in the deep sea and on sea-mountains; (JG) conceptions and hypotheses of marine biodiversity, biodiversity of marine vertebrates; (GG) animal migrations and dispersal behaviour.

A lecture comprises the above-mentioned subjects and imparts marine biological theories, research results and methods.

In the seminar, research is presented and discussed.

In the laboratory course/exercises, subjects are treated in coordination with the contents of the lecture. With the aid of a computer, data are analysed and interpreted statistically.

**Reader’s advisory**
- as announced in the lecture

**Links**
- Language of instruction: German
- Duration (semesters): 1 Semester
- Module frequency: jährlich
- Module capacity: unlimited
- Modullevel: MM (Mastermodul / Master module)
- Modulart: Wahlpflicht / Elective

**Lern-/Lehrform / Type of program**
- Vorkenntnisse / Previous knowledge

**Examination**
- Time of examination
- Type of examination
  - Written examination (60 %)
  - Presentation(s) (40 %)
- Regular active participation is required for the module to be passed.

**Final exam of module**
- Comment
- SWS
- Frequency
- Workload attendance
  - Lecture: 3.00 WiSe 42 h
  - Exercises: 9.00 WiSe 126 h
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**Total time of attendance for the module** 182 h
bio780 - Biodiversity of Littoral Communities

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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>• Thomas Glatzel</td>
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<tr>
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<td>Authorized examiners</td>
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<td></td>
<td>• Thomas Glatzel</td>
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<td>• Pedro Miguel Martinez Arbizu</td>
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<td>Module counseling</td>
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<td>• Pedro Miguel Martinez Arbizu</td>
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<td>Entry requirements</td>
<td>Safe apnoediving with aptitude test and medical fitness certificate</td>
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<tr>
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<td>• teamwork</td>
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<td>• ethics and professional behaviour</td>
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<td></td>
<td>• project and time management</td>
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</tbody>
</table>

By actively participating in this module students acquire qualifications in the following fields:

- Biological oceanography, marine biology and marine ecology:
  - Geological formation history of the Mediterranean Sea and Atlantic Ocean, respectively, or the Red Sea and adjacent seas
  - Oceanography and hydrology
  - Development of the faunal and floral composition of the Atlantic Ocean, the Mediterranean Sea and the Mediterranean region or the Red Sea (biogeography)
  - Commercial utilization of the seas and its impacts
  - Biotopes and biotic communities
  - Evolution, systematics, morphology, modes of life, and ecology of selected animal groups
  - Applying theoretical knowledge to real-world organisms/systems
  - Improved and specialized knowledge of species
  - Adaptation of life cycles
  - Interaction between organisms and environment
  - Dynamics of reef-building and reef-degrading processes
  - Threat to coral reefs/protection of marine environments

Methods:

- Formulation and definition of scientific approaches and selection of methods
- Observation and investigation of organisms and their habitats (snorkelling/diving)
- Documentation of small research projects in groups in the style of a scientific publication
- Editorial work to prepare a module report
- Popular presentation of results to be published by the media and to be presented at the University

Further skills:

- Social engagement in groups/teamwork in projects
- Independent scientific work in groups
- Improvement of scientific discussion culture
- Consciousness of the threat to coral reefs
- Practising English
- Dealing with the culture of the visited region

Culture:
- History, culture, politics, and religion

Additionally:

- Physiological aspects of apnoediving
- Measures in case of accidents (also caused by "poisonous" organisms)
### Module contents

Biodiversity of littoral biotic communities – topographical field research

### Reader's advisory

**GRÜTER, W., 2001:** Leben im Meer - Vielfalt und Zusammenhänge. Dr. Friedrich Pfeil Verlag, München.
*Should be read prior to a marine biological excursion! This book will arouse your curiosity about the submarine world. A reading book!*

*This textbook is information and fun for all readers interested in marine life as well as in the protection of marine environments.*

*The textbook for the Mediterranean Sea! The general 1st part provides valuable information on symbioses or feeding types, for example.*

*Very compact, explanatory! Not expensive! A must for biological oceanography! Recommended for preparing examinations! Provides basic information!*

*Highly illustrative! Much additional information on different fields! The authors provide a unique ecological approach that helps students understand the real-world relevance of marine biology by exploring how organisms interact within their individual ecosystems.*

*Connecting biological oceanography with theoretical ecology!*

Literature study:

*Web of science: externhttp://www.bis.uni-oldenburg.de – Data banks(DBIS) – Biology – TOP data banks, e.g. ASFA, Science Citation Index, Zoological Record http://www.biodiversitylibrary.org/bibliography/14107 externhttp://scholar.google.de/ externhttp://www.vifabio.de*

Open access journals: externhttp://www.doaj.org/ - externhttp://www.plosone.org

### Links

**Language of instruction**

German

**Duration (semesters)**

1 Semester

**Module frequency**

jährlich

**Module capacity**

unlimited

**Modullevel**

MM (Mastermodul / Master module)

**Modulart**

Wahlpflicht / Elective

**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

Time of examination

Type of examination

Final exam of module during the lectures 1. Report(s) (30 %)
2. Assignment (70 %) (project report in the style of a scientific publication)

**PLEASE NOTE:**

Additional conditions regarding attendance and ungraded activities as determined by the persons responsible for the module will apply.

### Workload attendance

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**Total time of attendance for the module**

168 h
bio733 - Evolutionary Biology Population Genetics

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<td>Gabriele Gerlach</td>
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<td>Gabriele Gerlach</td>
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<td>Dirk Carl Albach</td>
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<td>Skills to be acquired in this module</td>
<td>+ vertiefte biologische Fachkenntnisse</td>
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<tr>
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<td>++ vertiefte Kenntnisse biologischer Arbeitstechniken</td>
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<tr>
<td></td>
<td>++ Fähigkeit zur Datenanalyse; ++ kritisches und analytisches Denken</td>
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<td></td>
<td>++ Statistik und wissenschaftliches Programmieren</td>
</tr>
</tbody>
</table>

|                             | Übung: Es werden Datensätze und Methoden vorgestellt und angewendet, um die Verbreitung und genetischen Austausch zwischen Populationen zu bestimmen. |

| Reader's advisory            | aktuelle wissenschaftliche Artikel zur Evolutionsbiologie Futuyama D. Evolutionary Biology, Elsevier, Hartl & Clark Priciples of Population Genetics, Sinauer |

| Links                        |                                          |
|------------------------------|                                          |
| Languages of instruction     | German, English                         |
| Duration (semesters)         | 1 Semester                              |
| Module frequency             | 12                                       |
| Module capacity              | associated with bio736 (Evolutionary Transcriptomics) (recommended) |
| Modulelevel                  | MM (Mastermodul / Master module)        |
| Modulart                     | Wahlpflicht / Elective                  |

| Lern-/Lehrform / Type of program |                                          |
|---------------------------------|                                          |
| Vorkenntnisse / Previous knowledge | Grundkenntnisse Evolutionsbiologie  |

<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>portfolio (60%)</td>
<td>presentation (40%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
<td>WiSe</td>
<td>14 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
</tr>
</tbody>
</table>

| Total time of attendance for the module | 56 h |
Module label: Evolutionary Transcriptomics

Module code: bio736

Credit points: 6.0 KP

Workload: 180 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules

Contact person:
- Module responsibility: Arne Nolte
- Authorized examiners: Arne Nolte, Sascha Laubinger, Udo Gowik
- Module counseling: Sascha Laubinger, Udo Gowik

Contact person: Sascha Laubinger, Udo Gowik

Entry requirements:
- none

Skills to be acquired in this module:
- + deepened biological expertise
- ++ deepened knowledge of biological working methods
- ++ data analysis skills; ++ critical and analytical thinking
- + independent searching and knowledge of scientific literature
- ++ data presentation and discussion in English (written and spoken)
- ++ statistics & scientific programming

Module contents:
Lecture: Gene expression represents the first step of the translation of genomic information into a phenotype. This phenotype is of broad interest in all disciplines of biology. Gene expression data can reveal how genetic changes at single genes manifest phenotypically and how gene expression is regulated. The same data can also explain differences in life history and adaptation to different environments. Different perspectives can be understood by studying mechanisms of gene regulation as well as broad scale transcriptomics analyses.

Exercise: We will generate and analyze gene expression data during the course including wet lab and computational methods. Practicals include the analysis of single-gene expression data as well as RNAseq data representing complete transcriptomes.

Reader's advisory:

Links:

Languages of instruction: German, English

Duration (semesters): 1 Semester

Module frequency: 1 Semester

Module capacity: 12

Reference text:
- associated with bio733: Evolutionary Biology Population Genetics (recommended)

Modullevel:
- MM (Mastermodul / Master module)

Modulart:
- Wahlpflicht / Elective

Lern- / Lehrform / Type of program:

Vorkenntnisse / Previous knowledge:
- Grundkenntnisse Evolutionsbiologie

Examination:
- Time of examination
- Type of examination

Final exam of module:
- portfolio (60%)
- presentation (40%)

Course type
<table>
<thead>
<tr>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>1.00</td>
<td>WiSe</td>
<td>14 h</td>
</tr>
<tr>
<td>Exercises</td>
<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
</tr>
</tbody>
</table>

Total time of attendance for the module: 56 h
bio675 - Molecular Ecology

Module label: Molecular Ecology
Module code: bio675
Credit points: 12.0 KP
Workload: 360 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules

Contact person:
- Module responsibility
  - Arne Nolte
- Authorized examiners
  - Arne Nolte
  - Gabriele Gerlach
- Module counseling
  - Gabriele Gerlach

Entry requirements:
- B.Sc. (Biologie, Umweltwissenschaften)
- M.Sc. (Biologie, Marine Umweltwissenschaften, Landschaftsökologie)

Skills to be acquired in this module:
The field of molecular ecology strives to identify relationships between species genotypes, phenotypes and ecological factors. It addresses questions about how organisms adapt and explains patterns of distribution and biodiversity. During the course, participants will get to know the biological background to design an experiment in the field of molecular ecology. We will discuss the state of the art according to literature. Participants will perform sampling and conduct steps of the analysis. The course will cover field methods (sampling) and lab methods (behavior experiments, genetic analyses, phenotypic analyses) as well as computer based analyses.

- 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
- ability to perform independent biological research
- data presentation and discussion in German and English (written and spoken)
- statistics & scientific programming

Module contents:
- Lecture: AN/GG - Molecular ecology background of specific study systems. The lectures will introduce a study system that will be analyzed during the course (study systems may vary from year to year). It is the goal of the lecture to provide students with background information to develop an experimental design of a field study during the practical.
- Exercise: AN/GG - Mixed course with laboratory and field exercises. Samples will be collected in the field. One goal of the course is to apply modern analyses to understand how organisms are distributed. Another aspect is the application of molecular markers to analyze behavioral experiments.

Reader's advisory:
will be announced during the course

Links:
Languages of instruction: German, English
Duration (semesters): 1 Semester

Module frequency:
Module capacity: 15
Reference text: associated with bio890 Current Topics of Biology (Seminar)
Modullevel: MM (Mastermodul / Master module)
Modulart: Wahlpflicht / Elective

Lern-/Lehrform / Type of program:

Vorkenntnisse / Previous knowledge:

Examination:
- Time of examination: during the module
- Type of examination: Präsentationen (50%), Portfolio (50%). Regular participation is a prerequisite to pass in the module.

Course type:
- Lecture
  - SWS: 2.00
  - Frequency: SuSe
  - Workload attendance: 28 h
<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises</td>
<td></td>
<td>6.00</td>
<td>SuSe</td>
<td>84 h</td>
</tr>
</tbody>
</table>

**Total time of attendance for the module**

112 h
bio605 - Molecular Genetics and Cell Biology

Module label  Molecular Genetics and Cell Biology
Module code  bio605
Credit points  12.0 KP
Workload  360 h

Used in course of study
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person
Module responsibility
- John Neidhardt
Authorized examiners
- John Neidhardt
- Karl-Wilhelm Koch
- Kathrin Thiedieck
Module counseling
- Karl-Wilhelm Koch
- Kathrin Thiedieck

Entry requirements  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  15
Module capacity  15
Reference text  associated with bio900
Modullevel  MM (Mastermodul / Master module)
Modulart  Wahlpflicht / Elective

Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge  Zellbiologische Grundkenntnisse, Genetik, Biochemie

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

Course type  Comment  SWS  Frequency  Workload attendance
<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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</thead>
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<tr>
<td>Lecture</td>
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<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
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<td>1.00</td>
<td>WiSe</td>
<td>14 h</td>
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<tr>
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<td>5.00</td>
<td>WiSe</td>
<td>70 h</td>
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Total time of attendance for the module 112 h
bio845 - Introduction to Development and Evolution

Module label  
Introduction to Development and Evolution

Module code  
bio845

Credit points  
6.0 KP

Workload  
180 h

Used in course of study  
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person  
Module responsibility
  - Ulrike Sienknecht

Authorized examiners
  - Ulrike Sienknecht
  - Maike Claußen

Module counseling
  - Maike Claußen

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

Skills to be acquired in this module:
++ deepened biological expertise
+ deepened knowledge of biological working methods
++ interdisciplinary thinking
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ ability to perform independent biological research
+ teamwork

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

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

Reader's advisory  
Literature:

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  
MM (Mastermodul / Master module)

Modulart  
Wahlpflicht / Elective

<table>
<thead>
<tr>
<th>Vorkenntnisse / Previous knowledge</th>
<th>organismic biology, developmental biology, evolutionary biology, neurobiology, genetics, molecular biology</th>
</tr>
</thead>
</table>

**Examination**  
Final exam of module  
Time of examination: same winter term  
Type of examination: oral exam of 30 minutes

<table>
<thead>
<tr>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>WiSe</td>
<td>28 h</td>
</tr>
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</table>

Total time of attendance for the module  
56 h
Lab Exercises in Development and Evolution

Module label: Lab Exercises in Development and Evolution
Module code: bio846
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person:
- Module responsibility: Ulrike Sienknecht
- Authorized examiners:
  - Ulrike Sienknecht
  - Hans Gerd Nothwang
- Module counseling:
  - Hans Gerd Nothwang

Entry requirements:
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 embryo handling, tissue preparation (including cryosectioning), dissection of inner ears, and the use of different histological 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 note-book
- know how to carry out formal laboratory reports (and the anatomy of a scientific paper)
- and in addition, 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 to be acquired in this module:
++ 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 in German and English (written and spoken)
++ teamwork
+ ethics and professional behaviour
++ project and time management

Module contents:
Lab exercises in comparative developmental biology on 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.

Lectures in the field of auditory system development, such as:
- Development of the Inner Ear
- Development of the Middle Ear
- Evolution of the Central and Peripheral Auditory System
- Development and Layout of the Central Auditory System

Reader's advisory:

Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency:
Module capacity: 6
selection criteria: sequence of registration

<table>
<thead>
<tr>
<th>Reference text</th>
<th>Associated with bio845 (previously neu110) (Introduction to Development and Evolution)</th>
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<tr>
<td>Modullevel</td>
<td>MM (Mastermodul / Master module)</td>
</tr>
<tr>
<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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</tbody>
</table>

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge
organismic biology, experience with lab work

<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>same winter term</td>
<td>report (50%) and presentation (50%)</td>
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<table>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<td>0.50</td>
<td>WiSe</td>
<td>7 h</td>
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<tr>
<td>Seminar</td>
<td></td>
<td>0.50</td>
<td>WiSe</td>
<td>7 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
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</table>

Total time of attendance for the module 56 h
bio860 - Comparative Developmental Biology

Module label: Comparative Developmental Biology
Module code: bio860
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules

Contact person:
Module responsibility:
- Ulrike Sienknecht

Authorized examiners:
- Ulrike Sienknecht

Module counseling:
- N. N.

Entry requirements:
- Skills to be acquired in this module:
  ++ deepened biological knowledge
  ++ deepened knowledge of techniques in biology
  ++ knowledge in data analysis and presentation
  + cross-disciplinary knowledge and thinking
  ++ critical and analytical thinking
  + independent searching and knowledge of scientific literature
  ++ ability to perform independent biological research
  + data presentation and discussion in German and English (written and spoken)
  + team work
  + ethics and professional behaviour
  ++ project and time management

Module contents:
Lectures and Lab exercises in topics of evolutionary developmental biology, i.e. comparative developmental biology, such as the development of sensory systems in different species.

Reader's advisory:

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

Module frequency:
Module capacity: 6 (Reihenfolge der Anmeldungen)

Reference text:
associated with bio845 Introduction to Development and Evolution

Modullevel:
MM (Mastermodul / Master module)

Modulart:
Wahlpflicht / Elective

Lern-/Lehrform / Type of program:

Vorkenntnisse / Previous knowledge:
organismic biology, experience with lab work

Examination:
Time of examination: same summer term
Type of examination: report (50%) and presentation (50%)

Final exam of module:
same summer term

Course type:
Lecture:
- SWS: 1.00
- SuSe
- Frequency: SuSe
- Workload attendance: 14 h

Exercises:
- SWS: 3.00
- SuSe
- Frequency: SuSe
- Workload attendance: 42 h

Total time of attendance for the module: 56 h
bio695 - Biochemical concepts in signal transduction

Module label: Biochemical concepts in signal transduction
Module code: bio695
Credit points: 12.0 KP
Workload: 360 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person:
- Module responsibility: Karl-Wilhelm Koch
- Authorized examiners:
  - Karl-Wilhelm Koch
  - Alexander Scholten
- Module counseling: Alexander Scholten

Entry requirements: 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:
- Module capacity: 20
- Module level: MM (Mastermodul / Master module)
- Module art: Wahlpflicht / Elective

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination:
- Time of examination: 90 minutes written exam
- Type of examination: written examination (50%) protocols (50%)

Course type:
- Lecture: 1.00 SWS, WiSe, 14 h
- Seminar: 1.00 SWS, WiSe, 14 h
- Exercises: 6.00 SWS, WiSe, 84 h

Total time of attendance for the module: 112 h
# neu210 - Neurosensory Science and Behaviour - Part A

<table>
<thead>
<tr>
<th>Module label</th>
<th>Neurosensory Science and Behaviour - Part A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu210</td>
</tr>
<tr>
<td>Credit points</td>
<td>9.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>270 h (4 SWS Lecture (VO) &quot;Neuroethology&quot; and &quot;Behavioural ecology&quot; Total workload 180h: 56h contact/ 60h background reading/ 64h exam preparation 2 SWS Seminar (SE) &quot;Current issues of ethology&quot; Total workload 90h: 28h contact/ 30h literature reading/ 32h preparation of presentation)</td>
</tr>
</tbody>
</table>
| Used in course of study | Master's Programme Biology (Master) > Background Modules
  - Master's Programme Biology (Master) > Background Modules
  - Master's Programme Neuroscience (Master) > Background Modules |
| Contact person | Module responsibility
  - Georg Martin Klump

  **Authorized examiners**
  - Jannis Hildebrandt
  - Georg Martin Klump
  - Ulrike Langemann
  - Henrik Mouritsen

  **Module counceling**
  - Ulrike Langemann
  - Jannis Hildebrandt
  - Henrik Mouritsen |
| Entry requirements | Fundamentals of Neurobiology, Bahavioural 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 |
| 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. |
| Links | Language of instruction English |
| Duration (semesters) | 1 Semester |
| Module frequency | jährlich |
| Module capacity | 30 |
| Reference text | Course in the second half of the semester
  Regular active participation is required to pass the module. |
<p>| Modulelevel | --- |
| Modulart | je nach Studiengang Pflicht oder Wahlpflicht |
| Lern-/Lehrform / Type of program | Fundamentals of Neurobiology, Bahavioural Biology, Evolution, Ecology |
| Vorkenntnisse / Previous knowledge | Fundamentals of Neurobiology, Bahavioural Biology, Evolution, Ecology |</p>
<table>
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<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>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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<table>
<thead>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>4.00</td>
<td></td>
<td>56 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td></td>
<td>28 h</td>
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</table>

**Total time of attendance for the module**

|                                                      | 84 h |
neu220 - Neurosensory Science and Behaviour - Part B

Module label
Neurosensory Science and Behaviour - Part B

Module code
neu220

Credit points
6.0 KP

Workload
180 h
(3 SWS Lecture (VO) "Introd. to Cognitive Neuroscience" and "Psychopharmacol." Total workload 135h: 45h contact/ 45 background reading/ 45h exam preparation 1 SWS Supervised excercise (UE) Total workload 45h: 14h contact/ 31h paper reading)

Used in course of study
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person
Module responsibility
  - Christiane Margarete Thiel

Authorized examiners
  - Carsten Gießing

Module counselng
  - Carsten Gießing

Entry 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

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 excercises either deepen that knowledge by excercises 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
<table>
<thead>
<tr>
<th>Duration (semesters)</th>
<th>1 Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module frequency</td>
<td>jährlich</td>
</tr>
<tr>
<td>Module capacity</td>
<td>30 (Recommended in combination with neu210 &quot;Neurosensor Science and Behaviour&quot;, neu300 &quot;Functional MRI data analysis&quot; Shared course components with (cannot be credited twice): bio610 and psy181 (5.02.614 &quot;Introduction to Cognitive Neuroscience&quot;, 5.02.615 &quot;Psychopharmacology&quot;) )</td>
</tr>
<tr>
<td>Reference text</td>
<td>Course in the second half of the semester Regular active participation is required to pass the module.</td>
</tr>
<tr>
<td>Modullevel</td>
<td>---</td>
</tr>
<tr>
<td>Modulart</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
</tr>
<tr>
<td>Lern-/Lehrform / Type of program</td>
<td>---</td>
</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Fundamentals of Neurobiology, Behavioural Biology</td>
</tr>
<tr>
<td>Examination</td>
<td>Time of examination</td>
</tr>
<tr>
<td>Final exam of module</td>
<td>as agreed, usually in the break after the winter term</td>
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<tr>
<td>Course type</td>
<td>Comment</td>
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<tr>
<td>Lecture</td>
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<tr>
<td>Exercises</td>
<td>1.00</td>
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<tr>
<td>Total time of attendance for the module</td>
<td>56 h</td>
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</table>
neu141 - Visual Neuroscience - Physiology and Anatomy

Module label
Visual Neuroscience - Physiology and Anatomy

Module code
neu141

Credit points
12.0 KP

Workload
360 h
(3 SWS Lecture (VO) Total workload 90 h: 30h contact / 60h background literature reading and preparation for sh 1 SWS Seminar (SE) Total workload 30h: 10h contact / 20h literature reading and preparation of result presentation 8 SWS Supervised exercise (UE) Total workload 240h: 200h contact / 40h results analysis, writing of short reports for portfolio)

Used in course of study
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person
Module responsibility
- Martin Greschner

Authorized examiners
- Martin Greschner
- Karin Dedek
- Ulrike Janssen-Bienhold
- Christian Puller

Entry requirements
Basic knowledge of neurobiology

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

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

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

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

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

Links

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
annually, summer term, first half (full time)

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

<table>
<thead>
<tr>
<th>Modullevel</th>
<th>MM (Mastermodul / Master module)</th>
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<tr>
<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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<td>Lern-/Lehrform / Type of program</td>
<td>Basic knowledge in neurobiology</td>
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<table>
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<th>Vorkenntnisse / Previous knowledge</th>
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<table>
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<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td>during the course (summer semester, first half)</td>
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<tr>
<td>In addition, mandatory but ungraded: seminar presentation</td>
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<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>28 h</td>
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</tbody>
</table>

Total time of attendance for the module 84 h
neu150 - Neuroanatomy

Module label: Neuroanatomy
Module code: neu150
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person:
- Module responsibility: Ulrike Janssen-Bienhold
- Authorized examiners: Karin Dedek
- Module counseling: Ulrike Janssen-Bienhold
- Karin Dedek

Entry requirements:
- 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 neuroanatomical experiments. Gaining modern methodological skills.

Module contents:
- 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.

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
- Modulelevel: BC (Basiscurriculum / Base curriculum)
- Modular: je nach Studiengang Pflicht oder Wahlpflicht

Lern-Lehrform / Type of program:
- Vorkenntnisse / Previous knowledge:

Examination:
- Time of examination: summer semester, first half
- Type of examination: Portfolio (75 %), report (25%)

Course type:
- Lecture: 1.00 SWS
- Seminar: 1.00 SWS
- Practical: 3.00 SWS

Frequency:
- SuSe

Workload attendance:
- 14 h
- 14 h
- 42 h

Total time of attendance for the module: 70 h
neu290 - Biophysics of Sensory Reception

Module label: Biophysics of Sensory Reception
Module code: neu290
Credit points: 6.0 KP
Workload: 180 h
Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules
Contact person:
Module responsibility: Michael Winkhofer
Authorized examiners:
- Michael Winkhofer
Entry requirements:
Recommended previous knowledge/skills: cell biology of neurons
Skills to be acquired in this module:
++ Neurosci. knowlg.
+ Independent research
+ Scientific Literature
++ Interdiscipl. knowlg.
+ Data presentation/discussion.
- to gain a general understanding of sensory reception
- to acquire specific knowledge of sensory reception at the molecular and cellular level, with focus on the relationship between structure and function of sensory molecules
- to be able to perform simple quantitative assessments of detection sensitivity to physical stimuli
- to understand common features in transduction pathways among various senses
Module contents:
Reader's advisory:
Required reading:
The reading list will be updated on an annual basis to include new developments. The current reading list can be found on StudIP.
Recommended textbook(s) or other literature:
Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: annually, summer term, second half
Module capacity: 20
Modullevel: MM (Mastermodul / Master module)
Modulart: Wahlpflicht / Elective
<table>
<thead>
<tr>
<th>Modulart</th>
<th>je nach Studiengang Pflicht oder Wahlpflicht</th>
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<tbody>
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<td>Lern-/Lehrform / Type of program</td>
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</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>cell biology of neurons</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>cell biology of neurons</td>
</tr>
<tr>
<td>Examination</td>
<td>Time of examination</td>
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<td>appr. one week after the last lecture</td>
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<table>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
</tbody>
</table>

| Total time of attendance for the module | 56 h |
neu360 - Auditory Neuroscience

Module label: Auditory Neuroscience
Module code: neu360
Credit points: 6.0 KP
Workload: 180 h
(1 SWS Lecture (VO) Total workload 45h: 14 h contact / 31 h background reading 1 SWS Seminar (SE) Total workload 45h: 14 h contact / 15 h background reading / 16 h preparation and presentation 2 SWS Supervised exercise (UE) Total workload 90h: 10 h contact / 20 h literature search / 60 h work on essay paper)

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person:
- Module responsibility: Christine Köppl
- Authorized examiners: Georg Martin Klump, Christine Köppl

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

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

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

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

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

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

Reader's advisory:
Required reading:
- About 20 selected original papers (selection varies)
- Recommended textbook(s) or other literature:
  - 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 (Recommended in combination with: BM neu211 "Neurosensory Science and Behaviour" or BM neu270 "Neurocognition and Psychophysics" or skills module biox "Current Topics in Hearing Science")
<table>
<thead>
<tr>
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<th>MM (Mastermodul / Master module)</th>
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<tbody>
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<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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**Lern-/Lehrform / Type of program**

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

<table>
<thead>
<tr>
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<tr>
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<td>within a few weeks of the end of summer term lecture period</td>
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<td>Lecture</td>
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<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
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<tr>
<td>Seminar</td>
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<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
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<td>Exercises</td>
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**Total time of attendance for the module**
84 h
**neu340 - Invertebrate Neuroscience**

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<tr>
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<tbody>
<tr>
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<tr>
<td>Credit points</td>
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<td>Workload</td>
<td>180 h</td>
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<tr>
<td></td>
<td>(1 SWS Seminar (SE) Total workload 45h: 15h contact / 30h background literature reading, preparation for short tests and results presentation 3 SWS Supervised exercise (UE) Total workload 135h: 70h contact / 65h data analysis and preparation of portfolio assignments)</td>
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<tr>
<td>Used in course of study</td>
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<tr>
<td></td>
<td>Master's Programme Biology (Master) &gt; Background Modules</td>
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<td></td>
<td>Master's Programme Neuroscience (Master) &gt; Background Modules</td>
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<tr>
<td>Contact person</td>
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<tr>
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<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Jutta Kretzberg</td>
</tr>
<tr>
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<td>Authorized examiners</td>
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<td>Jutta Kretzberg</td>
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<tr>
<td>Entry requirements</td>
<td>attendance in pre-meeting</td>
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<tr>
<td>Skills to be acquired in this module</td>
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</tr>
<tr>
<td></td>
<td>EEG Neurosci. knowlg.</td>
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<tr>
<td></td>
<td>EEG Expt. Methods</td>
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<td>EEG Scient. Literature</td>
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<td>EEG Social skills</td>
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<td>EEG Data present./disc.</td>
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<td>Scientific English</td>
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<tr>
<td></td>
<td>Ethics</td>
</tr>
<tr>
<td>Upon successful completion of this course, students</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• have knowledge on invertebrate neuronal systems in comparison to vertebrate systems</td>
</tr>
<tr>
<td></td>
<td>• have discussed an overview of experimental and theoretical methods of invertebrate neuroscience</td>
</tr>
<tr>
<td></td>
<td>• have acquired first practical skills in intracellular recordings from invertebrate neurons</td>
</tr>
<tr>
<td></td>
<td>• have acquired basic skills in data analysis</td>
</tr>
<tr>
<td></td>
<td>• have acquired an intuitive understanding of membrane potential and action potential generation based on computer simulations</td>
</tr>
<tr>
<td>Module contents</td>
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<tr>
<td></td>
<td>The background module Neurophysiology 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</td>
</tr>
<tr>
<td>Reader's advisory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course scripts and mandatory scientific literature (3 review articles) discussed in the seminar will be available in Stud.IP</td>
</tr>
<tr>
<td></td>
<td>Background and seminar literature will be available in Stud.IP</td>
</tr>
<tr>
<td>Links</td>
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</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Module frequency</td>
<td>annually, summer term, second half</td>
</tr>
<tr>
<td>Module capacity</td>
<td>12 ( this module provides the background for neu345 “Neural Computation in invertebrate systems” )</td>
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<tr>
<td>Modullevel</td>
<td>MM (Mastermodul / Master module)</td>
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<tr>
<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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<tr>
<td>Lern-/Lehrform / Type of program</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>basic knowledge of neurobiology, basic MATLAB programming skills</td>
</tr>
<tr>
<td>Examination</td>
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<tr>
<td>Time of examination</td>
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<td>Type of examination</td>
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<tr>
<td>Final exam of module</td>
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<tr>
<td>during the course (summer term, second half)</td>
<td>Portfolio consisting of short tests and short reports In addition, mandatory but ungraded: seminar presentation</td>
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<td>Comment</td>
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<td>SWS</td>
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<td>-------------</td>
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<tr>
<td>Seminar</td>
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<tr>
<td>Exercises</td>
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</table>

**Total time of attendance for the module** 56 h
neu300 - Functional MRI data analysis

Module label: Functional MRI data analysis
Module code: neu300
Credit points: 12.0 KP
Workload: 360 h
- 3 SWS Practical (PR) Total workload 225h: 70h contact / 100h experimental work / 55h exam preparation
- 2 SWS Lecture (VO) Total workload 90h: 28h contact / 30h background reading / 32h exam preparation
- 1 SWS Seminar (SE) Total workload 45h: 15h contact / 30h preparation of presentation

Used in course of study:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Contact person:
- Module responsibility
  - Carsten Gießing
- Authorized examiners
  - Carsten Gießing
  - Christiane Margarete Thiel

Entry requirements:
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 modul 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)
Modulelevel: MM (Mastermodul / Master module)
Moduleart: Wahlpflicht / Elective
Modulart: je nach Studiengang Pflicht oder Wahlpflicht
Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge
Examination: Time of examination: end of summer term
Type of examination: 70% oral exam or written exam, 30% presentations
In addition, mandatory but ungraded: Regular active participation

Course type | Comment | SWS | Frequency | Workload attendance |
--- | --- | --- | --- | --- |
Practical | | 5.00 | SuSe | 70 h |
Seminar | | 1.00 | SuSe | 14 h |
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<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
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</tbody>
</table>

**Total time of attendance for the module**

112 h
### neu310 - Psychophysics of Hearing

**Module label**  
Psychophysics of Hearing

**Module code**  
neu310

**Credit points**  
12.0 KP

**Workload**  
360 h  
- 5 SWS Practical (PR) "Experiments in Hearing" Total workload 225h: 70h contact / 110h experimental work / 45h exam preparation  
- 1 SWS Supervised exercise (UE) "Fundamentals in psychoacoustic data analysis" Total workload 45h: 15h contact / 30h practising data analysis (incl. SPSS)  
- 2 SWS Seminar (SE) "Hearing" Total workload 90h: 30h contact / 60h background reading

**Used in course of study**  
- Master's Programme Biology (Master) > Background Modules  
- Master's Programme Biology (Master) > Background Modules  
- Master's Programme Neuroscience (Master) > Background Modules

**Contact person**  
Module responsibility  
- Georg Martin Klump

**Authorized examiners**  
- Georg Martin Klump  
- Ulrike Langemann

**Entry requirements**  
**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 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**  
MM (Mastermodul / Master module)

**Modulart**  
Wahlpflicht / Elective

**Modulart je nach Studiengang Pflicht oder Wahlpflicht**

**Lern-/Lehrform / Type of program**

**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

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises</td>
<td></td>
<td>1.00</td>
<td>SuSe</td>
<td>14 h</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Practical</td>
<td></td>
<td>5.00</td>
<td>SuSe</td>
<td>70 h</td>
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<tr>
<td>Lecture</td>
<td></td>
<td>0.00</td>
<td>SuSe</td>
<td>0 h</td>
</tr>
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**Total time of attendance for the module**  
112 h
Research Modules

bio900 - Biology Research Module

Module label | Biology Research Module
Module code | bio900
Credit points | 15.0 KP
Workload | 450 h

Used in course of study
- Master's Programme Biology (Master) > Research Modules
- Master's Programme Biology (Master) > Research Modules

Contact person
Module responsibility
- Gerhard Wolfgang Zotz
Authorized examiners
- Gerhard Wolfgang Zotz
- Lehrende der Biologie

Entry requirements
project and supervisor(s) need to be approved by the exam board prior to the start of lab work

Hinweise:
all members of the regular IBU Biology faculty at the University of Oldenburg can act as local supervisor, 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 local supervisor
participation in a joint poster presentation of concurrent research modules is highly recommended.

Skills to be acquired in this module
Students will learn to plan, perform and analyse a study in a biological field. Topics will be chosen in close coordination with teaching staff. Depending on the particular project, knowledge in statistics, molecular biology, physiology, modelling, or ethology will be necessary. Results will be related to the current biological literature in a written report and be presented in the seminar of the hosting working group.

- 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 in German and English (written and spoken)
- teamwork
- project and time management
- statistics & scientific programming

Module contents
The students develop an empirical investigation, carry it out and analyse the results. The students present and discuss their project both orally and in writing

Reader's advisory

Links

Languages of instruction | German, English
Duration (semesters) | 1 Semester
Module frequency
Module capacity | unlimited
Reference text
Within the Modul bio900 is it possible to take several courses as long as their contents differ substantially. When taking the course group 5.02.960 it is mandatory to choose two courses out of the group A – D.

Modulelevel | MM (Mastermodul / Master module)
Modulart | Wahlpflicht / Elective
Lern-Lehrform / Type of program
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>Projektorientiertes Modul</td>
<td>internship report</td>
</tr>
<tr>
<td>Course type</td>
<td>Projektorientiertes Modul</td>
<td></td>
</tr>
<tr>
<td>SWS</td>
<td>10.00</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>SuSe and WiSe</td>
<td></td>
</tr>
<tr>
<td>Workload attendance</td>
<td>140 h</td>
<td></td>
</tr>
</tbody>
</table>
bio810 - Independent Research

Module label: Independent Research
Module code: bio810
Credit points: 15.0 KP
Workload: 450 h

Used in course of study:
- Master's Programme Biology (Master) > Research Modules
- Master's Programme Biology (Master) > Research Modules

Contact person:
Module responsibility:
- Gerhard Wolfgang Zotz

Authorized examiners:
- Gerhard Wolfgang Zotz
- Lehrende der Biologie

Entry requirements:
External research projects are done on an individual basis. They are supervised by one person from Oldenburg and a local supervisor at any university or research institution in Germany and abroad. Please contact Gerhard Zotz (Gerhard.zotz@uol.de) for details. See https://uol.de/ibu/studium-und-lehre/fach-master-biology/downloads-und-links/ (Learning Agreement for External Research Module)

Skills to be acquired in this module:
++ 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 in German and English (written and spoken)
+ teamwork
++ project and time management
++ statistics & scientific programming

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 in publication format
- prepare and present a scientific poster

Module contents:
Students are introduced to independent research in a specific area of biology by a scientific working group outside of the regular IBU Biology faculty at the University of Oldenburg (usually a university research institute in Germany or abroad)

The content and venue of this module is chosen in close coordination with the Prüfungsausschuss Master Biologie, possibly with consultations of other professors. Course work should cover all parts of a scientific project, i.e. data collection, data analysis and the presentation of the results. Irrespective of the particular venue (universities, research institutes) the student has to report to a professor in Oldenburg in form of a written report and an oral presentation, both in English.

Note:
- all members of the regular IBU Biology faculty at the University of Oldenburg can act as local supervisor, 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 local supervisor
- participation in a joint poster presentation of concurrent research modules is highly recommended.

Reader's advisory:
varies with chosen topic

Links
Languages of instruction: English, German
Duration (semesters): 1 Semester
Module frequency: halbjährlich
Module capacity: unlimited
Modullevel: MM (Mastermodul / Master module)
Modulart: Wahlpflicht / Elective
### Lern-/Lehrform / Type of program

### 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></td>
<td>internship report</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar</td>
<td></td>
<td>1.00</td>
<td>SuSe and WiSe</td>
<td>14 h</td>
</tr>
<tr>
<td>Projektorientiertes Modul</td>
<td></td>
<td>10.00</td>
<td>SuSe and WiSe</td>
<td>140 h</td>
</tr>
</tbody>
</table>

**Total time of attendance for the module**: 154 h
bio820 - Research Module Fast Track

**Module label**: Research Module Fast Track

**Module code**: bio820

**Credit points**: 15.0 KP

**Workload**: 450 h

**Used in course of study**:
- Master's Programme Biology (Master) > Research Modules
- Master's Programme Biology (Master) > Research Modules

**Contact person**

- Module responsibility:
  - Georg Martin Klump
- Authorized examiners:
  - Georg Martin Klump

**Entry requirements**

**Skills to be acquired in this module**

- ++ 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 in German and English (written and spoken)
- + teamwork
- ++ project and time management
- ++ statistics & scientific programming

**Module contents**

**Reader's advisory**

**Links**

**Languages of instruction**: German, English

**Duration (semesters)**: 1 Semester

**Module frequency**: unregelmäßig

**Module capacity**: unlimited

**Modullevel**: ---

**Modulart**: je nach Studiengang Pflicht oder Wahlpflicht

**Lern-/Lehrform / Type of program**: intership report

**Vorkenntnisse / Previous knowledge**

**Examination**

**Time of examination**: Time of examination

**Type of examination**: Type of examination

**Final exam of module**: written report

**Course type**: Seminar

**SWS**: 0.00

**Frequency**: --

**Workload attendance**: 0 h
Skills Modules

**bio870 - Communicating Plant Sciences**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Communicating Plant Sciences</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>bio870</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
</tr>
<tr>
<td>Used in course of study</td>
<td></td>
</tr>
</tbody>
</table>
  - Master's Programme Biology (Master) > Skills Modules  
  - Master's Programme Biology (Master) > Skills Modules |
| Contact person       | Module responsibility       |
|                      | Gerhard Wolfgang Zotz       |
|                      | Authorized examiners        |
|                      | Gerhard Wolfgang Zotz       |
|                      | Sascha Laubinger            |
|                      | Dirk Carl Albach            |
|                      | Module counseling           |
|                      | Sascha Laubinger            |
|                      | Dirk Carl Albach            |
| Entry requirements   | Skills to be acquired in this module |
|                      | Communicating and practicing scientific presentation techniques (talk, publication, poster)  
                      | Presentation of data and discussion in spoken and written (english)  
                      | Communicating of techniques in problem treatment in free speech and scientific writing  
                      | Independent investigation and knowledge of scientific primary literature  
                      | + interdisciplinary thinking  
                      | ++ critical and analytical thinking  
                      | ++ independent searching and knowledge of scientific literature  
                      | ++ data presentation and discussion in German and English (written and spoken) |
| Module contents      | S: Working group seminar (2 SWS; Choice 1: Functional Ecology; Choice 2: Evolutionary genetics of plants; Choice 3: Plant biodiversity and evolution)  
                      | S: Scientific Writing in Plant Science (2SWS) |
| Reader's advisory    |                             |
| Languages of instruction | German, English            |
| Duration (semesters) | 1 Semester                  |
| Module frequency     |                             |
| Module capacity      | 12                          |
| Modulelevel          | MM (Mastermodul / Master module)  
                      | Wahlmodul / Opportunity |
| Lern-/Lehrform / Type of program |  
                      | Ökologie, Flora, Genetik |
| Vorkenntnisse / Previous knowledge |                             |
| Examination          | Time of examination          |
|                      | Final exam of module         |
|                      | 1 presentation (25%)          |
|                      | 1 report (75%)               |
| Course type          | Seminar                      |
| SWS                  | 4.00                        |
| Frequency            | WiSe                        |
| Workload attendance  | 56 h                        |
bio880 - Skills in Plant Systematics

Module label: Skills in Plant Systematics
Module code: bio880
Credit points: 6.0 KP
Workload: 180 h

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules

Contact person:
Module responsibility:
  - Dirk Carl Albach
Authorized examiners:
  - Dirk Carl Albach
  - Klaus Bernhard von Hagen
  - Thijs Janzen
Module counseling:
  - Klaus Bernhard von Hagen

Entry requirements:
Skills to be acquired in this module:
In this module, we provide the skills necessary to describe and distinguish species for floras and monographs/first publication of species. For that, an overview over the plant kingdom is provided. Further, various non-molecular methods of systematics are practiced, such as morphometry, SEM, identification key generation, nomenclature, species delimitation methods, and interpretation of phylogenetic analyses.

- 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 in German and English (written and spoken)
- teamwork
- statistics & scientific programming

Module contents:
In the seminar we provide an overview over the larger groups of plants and characters for their grouping. We analyse methods for phylogeny generation, angiosperm classification and description of new taxa. In the exercises morphological characters are investigated in various ways and internet resources for further morphological characters presented. Species delimitation methods for molecular and morphological characters are used. Identification keys are generated and nomenclatural rules discussed.

Reader's advisory:

Links:
Languages of instruction: German, English
Duration (semesters): 1 Semester

Module frequency:
Module capacity: 8
Modullevel: MM (Mastermodul / Master module)
Modulart: Wahlmodul / Opportunity

Lern-/Lehrform / Type of program:
Vorkenntnisse / Previous knowledge:
gute Kenntnisse der heimischen Flora

Examination:
Time of examination:
Type of examination:
Final exam of module:
1 presentation
1 report

Course type:
Seminar:
Exercises:

Comment:
SWS:
Frequency:
Workload attendance:
Seminar:
2.00
WiSe
28 h
Exercises:
2.00
WiSe
28 h

Total time of attendance for the module:
56 h
bio890 - Current Topics in Biology

Module label: Current Topics in Biology
Module code: bio890
Credit points: 3.0 KP
Workload: 90 h

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules

Contact person:
- Module responsibility: Gabriele Gerlach
- Authorized examiners: Olaf Bininda-Emonds
- Module counseling: Lehrende der Biologie

Entry requirements:

Skills to be acquired in this module:
+ biological knowledge
+ biologically relevant, natural / mathematical scientific basic knowledge
++ interdisciplinary knowledge and thinking
++ abstract, logical, and analytical thinking
++ expanded knowledge in a specific biological field
++ presentation of results and factual discussion, both written and spoken
++ (scientific) communication skills

To develop skills in the critical analysis and interpretation of results and themes in diverse areas of modern biology, including (but not limited to) evolutionary biology, population genetics, biodiversity, ecology, genomics, ornithology, and neurobiology.

Module contents:
Discussion and interpretations of one or more themes in modern biology. The themes and exact content will be provided by the instructor(s) at the beginning of the course.

Reader's advisory:
Varies with chosen topic (will be provided by the instructor(s) at the beginning of the course)

Links:
Languages of instruction: English , German
Duration (semesters): 1 Semester

Module frequency
Module capacity: unlimited
Modulelevel: MM (Mastermodul / Master module)
Modulart: Wahlmodul / Opportunity

Lern-/Lehrform / Type of program
Vorkenntnisse / Previous knowledge: Teilnahme in einem oder mehreren Grundmodulen des Master Biologie
Examination:
Time of examination: 
Type of examination: 
Final exam of module: open
Portfolio
Course type: Seminar

SWS: 2.00
Frequency: SuSe and WiSe
Workload attendance: 28 h
neu770 - Basics of Statistical Data Analysis

Module label: Basics of Statistical Data Analysis
Module code: neu770
Credit points: 6.0 KP
Workload: 180 h
(1.5 SWS Lecture (VO) Total workload 68h: 28h contact / 20h background reading / 20h exam preparation 2.5 SWS Seminar (SE) Total workload 113h: 28h contact / 20h background reading / 65h exercise solving)

Used in course of study:
- 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

Contact person:
Module responsibility
- Fabian Otto-Sobotka
Authorized examiners
- Fabian Otto-Sobotka

Entry requirements:
Skills to be acquired in this module:
- Social skills
- Interdiscipl. knowl.
- ++ Maths/Stats/Progr.
- Scientific English

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
Module level: ---
Module type: Wahlpflicht / Elective

Lern-/Lehrform / Type of program:
Vorkenntnisse / Previous knowledge: basic mathematical knowledge; one of probabilities recommended in combination with neu720 Statistical programming with R

Examination:
- Time of examination: after the course
- Type of examination: written exam, 2h

Course type:
- Lecture: 2.00 SWS, Frequency: 28 h
- Seminar: 2.00 SWS, Frequency: 28 h

Total time of attendance for the module: 56 h
neu720 - Statistical programming in R

<table>
<thead>
<tr>
<th>Module label</th>
<th>Statistical programming in R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu720</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h (1.5 SWS Lecture (VO) Total workload 68h: 28h contact / 20h background reading / 20h exam preparation 2.5 SWS Supervised exercise (UE): Total workload 113h: 28h contact / 20h background reading / 65h exercise solving)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Contact person</th>
<th>Module responsibility</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Fabian Otto-Sobotka</td>
</tr>
<tr>
<td></td>
<td>Authorized examiners</td>
</tr>
<tr>
<td></td>
<td>Fabian Otto-Sobotka</td>
</tr>
</tbody>
</table>

| Entry requirements      | + 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

<table>
<thead>
<tr>
<th>Module contents</th>
<th>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.</th>
</tr>
</thead>
</table>
|                         | R Core Team - R: A language and environment for statistical computing (Reference Manual)

<table>
<thead>
<tr>
<th>Links</th>
<th>Language of instruction: English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duration (semesters): 1 Semester</td>
</tr>
<tr>
<td></td>
<td>Module frequency: annually, summer term</td>
</tr>
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<td></td>
<td>Module capacity: 24</td>
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<tr>
<td>Reference text</td>
<td>Recommended previous knowledge / skills: basic statistical knowledge including regression analysis</td>
</tr>
<tr>
<td>Modullevel</td>
<td>---</td>
</tr>
<tr>
<td>Modular</td>
<td>Wahlpflicht / Elective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lern-/Lehrform / Type of program</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time of examination</td>
</tr>
<tr>
<td>Final exam of module</td>
<td>after the course</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
</tbody>
</table>

Total time of attendance for the module: 56 h
# Neu730 - Biosciences in the Public Eye and in our Laws

<table>
<thead>
<tr>
<th>Module label</th>
<th>Biosciences in the Public Eye and in our Laws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module code</td>
<td>neu730</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h (3.5 SWS Supervised exercise (UE) Total workload 158 h: 48h contact / 40h preparation of presentation / 70h term paper 0.5 SWS Lecture (VO) Total workload 23 h: 10 h contact / 13 h background research)</td>
</tr>
</tbody>
</table>

**Used in course of study**

- 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 Political Science (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme program in Environment Protection (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Biologie
- Bachelor's Programme Sustainability Economics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Art and Media (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Biology (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Chemistry (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Computing Science (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Dutch Linguistics and Literary Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Economics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme General Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme History (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Music (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme 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 Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Contact person**

- Module responsibility
  - Christine Köppl
- Authorized examiners
  - Christine Köppl
Ulrike Sienknecht  
Module counseling  

Entry requirements  
keine

Skills to be acquired in this module  
+ Scient. Literature  
++ Social skills  
+ Data present./disc.  
++ Ethics  

Upon completion of this course, students  
- have basic knowledge of non-biological aspects of professional life (e.g., law, management, languages)  
- know the basic safety and environmental concerns in bioscientific workplaces  
- are able to critically define and discuss ethical conflicts in biological research, e.g., in the context of stem cell research or data manipulation  
- have the ability to communicate scientific concepts, both orally and in writing  
- are able to prepare and give a coherent presentation in a team  
- have practised to lead a group discussion

Module contents
Lectures introduce the legal framework and the application procedures for experimental work with animals, humans and genetically modified organisms. In supervised exercises, students research the ethical aspects and controversial issues of about 10 particular topics in the biosciences. They 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
Current law and interpretative commentaries, e.g., by the German Research Council (DFG) or the German Ethics Panel
Introductory papers aimed at lay persons, e.g. from "The Scientist" or widely respected newspapers
Problem-based, independent search for relevant scientific literature is an integral part of this module

Links
Languages of instruction  
German, English

Duration (semesters)  
1 Semester

Module frequency  
annually, summer term

Module capacity  
18

Modullevel  
---

Modulart  
Wahlpflicht / Elective

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination  
Time of examination  
Type of examination

Final exam of module  
within a few weeks of summer term lecture period  
Term paper  
In addition, mandatory but ungraded: Regular participation during the semester is required (max 3 days of absence)

Course type  
Comment  
SWS  
Frequency  
Workload attendance

Lecture  
2.00  
SuSe  
28 h

Seminar und Übung  
2.00  
SuSe  
28 h

Total time of attendance for the module  
56 h
### neu740 - Molecular Mechanisms of Ageing

<table>
<thead>
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<th>Module label</th>
<th>Molecular Mechanisms of Ageing</th>
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<tbody>
<tr>
<td>Module code</td>
<td>neu740</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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</table>

- 4 SWS Supervised exercise (UE)
- Total workload: 180h
- 26h contact
- 50h group work
- 50h prep. of thesis, presentations
- 54h recap. literature

**Used in course of study**

- 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
- Dual-Subject Bachelor's Programme Economic Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Economics and Business Administration (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Elementary Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme English Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Gender Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme German Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme History (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Material Culture: Textiles (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Mathematics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Music (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Philosophy / Values and Norms (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Physics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Politics-Economics (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Protestant Theology and Religious Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Slavic Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Social Studies (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Special Needs Education (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Sport Science (Bachelor) > Fachnahe Angebote Biologie
- Dual-Subject Bachelor's Programme Technology (Bachelor) > Fachnahe Angebote Biologie
- Fach-Bachelor Pädagogisches Handeln in der Migrationsgesellschaft (Bachelor) > Fachnahe Angebote Biologie
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

**Contact person**

Module responsibility
- Kathrin Thedieck
- Lena Ebbers

Authorized examiners
**Entry requirements**

**Skills to be acquired in this module**

- Neurosci. knowlg.
- Expt. methods
- Scient. literature
- Social skills
- Interdiscipl. knowlg.
- Data present./disc.
- Scientific English
- Ethics

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 ressentation 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.

**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, Therapieansa?tze
Ludger Rensing; Volkhard Rippe

**Links**

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: annually, summer term
- Module capacity: 16
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<th>Modullevel</th>
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<tbody>
<tr>
<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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<tr>
<td>Lern-/Lehrtyp / Type of program</td>
<td></td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>end of semester</td>
<td>portfolio: thesis paper, oral presentation, poster presentation In addition, mandatory but ungraded: questionnaire on ageing theories, meeting protocols</td>
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<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2.00</td>
<td>SuSe</td>
<td>28 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>4.00</td>
<td>SuSe</td>
<td>56 h</td>
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</table>

**Total time of attendance for the module** 84 h
neu751 - Laboratory Animal Science

Module label  Laboratory Animal Science
Module code    neu751
Credit points  3.0 KP

Workload  90 h
(one week full-time in semester break + flexible time for studying and exam preparation 1 SWS Lecture total workload 45h: 2h contact / 20h background reading / 23h exam preparation 1 SWS Supervised exercise total workload 45h: 35h contact / 10h background reading)

Used in course of study
• Master’s Programme Biology (Master) > Skills Modules
• Master’s Programme Biology (Master) > Skills Modules
• Master’s Programme Neuroscience (Master) > Skills Modules

Contact person
Module responsibility
• Christine Köppl
Authorized examiners
• Christine Köppl
• Georg Martin Klump
• Ulrike Langemann
• Arne Nolte

Entry requirements  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”. We aim to obtain accreditation by the Federation of European Laboratory Animal Science Associations (FeLaSa) by 2018.

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 • Transectional perfusion • Anaesthesia and surgery

Reader’s advisory
"LAS interactive" internet-based learning platform

Links
Language of instruction  English
Duration (semesters)  1 Semester
Module frequency  semester break, every semester
Module capacity  15 (Registration procedure / selection criteria: StudIP, sequence of registration)

Modullevel  ---
Modular  je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program
### Vorkenntnisse / Previous knowledge

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<td>Final exam of module</td>
<td>immediately before the practical part</td>
<td>written exam of 90 minutes</td>
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<th>Frequency</th>
<th>Workload attendance</th>
</tr>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
<td>SuSe and WiSe</td>
<td>14 h</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>1.00</td>
<td>SuSe and WiSe</td>
<td>14 h</td>
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**Total time of attendance for the module**: 28 h
neu760 - Scientific English

Module label: Scientific English
Module code: neu760
Credit points: 6.0 KP
Workload: 180 h
- (0.5 SWS Lecture (VO) Total workload 23h: 8h contact / 15h research for term paper
- 3.5 SWS Supervised exercise (UE) Total workload 158h: 46h contact / 46h preparation of texts and presentations / 66h term paper)

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Contact person:
Module responsibility
- Christine Köppl
Authorized examiners
- Jannis Hildebrandt

Entry requirements:
- 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. They are able to express themselves with correct sentence structure and grammar, correct use of idioms and correct pronunciation. They are proficient in different contexts of scientific communication (e.g., paper, poster and informal exchange by email or phone). They 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:
Additional teachers in the module: outsourced to STELS-OL (Scientific and Technical English Language Service, Oldenburg); native English speaker with in-depth neuroscience knowledge
<table>
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<th>Module level</th>
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<tbody>
<tr>
<td>Modulart</td>
<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**
English level B2 according to Common European Framework of Reference for Languages (CEFR)

**Examination**
- Time of examination: within 2 months of completing the course
- Type of examination: Portfolio: 50% presentation, 50% assignment; bonus for active participation

**Course type**

<table>
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<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1.00</td>
<td>WiSe</td>
<td>14 h</td>
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<td></td>
<td>3.00</td>
<td>WiSe</td>
<td>42 h</td>
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**Total time of attendance for the module**
56 h
neu780 - Introduction to Data Analysis with Python

Module label: Introduction to Data Analysis with Python
Module code: neu780
Credit points: 6.0 KP
Workload: 180 h
(2 SWS Lecture total workload 90h: 30h contact / 60h individual reading
2 SWS Supervised exercise total workload 90h: 45h contact / 45h solving programming exercises)

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Contact person:
Module responsibility
- Michael Winkhofer

Authorized examiners
- Michael Winkhofer

Entry requirements:

Skills to be acquired in this module:
+ Neurosci. knowlg.
++ Maths/Stats/Progr.
+ Data present./disc.

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

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
http://www.swaroopch.com/notes/python/
http://docs.python.org/3/tutorial/index.html

Links:

Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: semester break, annually
Module capacity: 20

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

Modullevel: ---

Modulart: Wahlpflicht / Elective

Lern-Lehrform / Type of program:

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

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

Course type: Lecture
Comment: 2.00 SWS
Frequency: WiSe
Workload attendance: 28 h

Course type: Exercises
Comment: 2.00 SWS
Frequency: WiSe
Workload attendance: 28 h

Total time of attendance for the module: 56 h
neu790 - Communicating Neuroscience

Module label: Communicating Neuroscience

Module code: neu790

Credit points: 3.0 KP

Workload: 90 h
(28 h contact / 62 h individual reading and preparing discussion questions)

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Contact person:

Module responsibility:
- Jutta Kretzberg

Authorized examiners:
- Jutta Kretzberg
- Jannis Hildebrandt
- Christine Köppl

Entry requirements:

Skills to be acquired in this module:
- Neurosci. knowlg.
- Independent research
- 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 neuroscience.

Critical reading of neuroscience literature:

identify article type and audience
summarize scientific contents
identify strengths and weaknesses of methods, conclusions etc.
put into scientific context
discuss manuscript style
discuss social and ethical context and implications of the study

Critical discussion of own studies:

present own results in a way that is appropriate for the target audience
put own studies into the context of scientific literature
acquire additional knowledge about a broader field of research

Module contents:
The overall goal of critical discussion of neuroscientific results in a scientific, social and ethical context can be achieved by different options: - Option 1: Seminar 'Neuroscience Journal Club': All students read and discuss 12 published papers (one each weak). Different fields of neuroscience (e.g. molecular, cellular, behavioral, computational) will be covered with one classical and one recent paper each. Papers and questions about each paper will be provided prior to the start of the seminar. Students prepare answers to these questions independently and discuss their answers during the seminar. The module is passed when a student actively participated in the discussion of at least 10 papers. - Option 2: Written report on a neuroscientific topic of the student's choice, based on scientific literature, e.g. in the context of an independent student study group. The report should discuss scientific results in a scientific and a social / ethical context. - Option 3: Active participation in a scientific conference, workshop, summer school etc.: Participation in a scientific conference, workshop, summer school etc. lasting a minimum of 3 full days can be credited with 3 ECTS, if the student presents own scientific results (poster, talk) obtained, e.g., in a research module or Master thesis. - Option 4: Participation in at least 20 scientific presentations (e.g. IBU / DfN colloquium, Hanse lecture neuroscience) and submission of a short (1 page) written summary of each talk. - For other individual options (e.g. teaching in neuroscience) ask the module organizer.

Reader's advisory:
Option 1 (seminar): List of 12 published papers will be provided prior to the course. All students are required to read at least 10 of those.
Other options: dependent on the scientific topic
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

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<tr>
<td>Language of instruction</td>
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**Lern-/Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

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<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td></td>
<td>none (only pass / fail) depend on the option chosen (see Module content)</td>
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**Course type**

- Seminar

**SWS**

- 2.00

**Frequency**

- SuSe and WiSe

**Workload attendance**

- 28 h
neu800 - Introduction to Matlab

Module label
Introduction to Matlab

Module code
neu800

Credit points
3.0 KP

Workload
90 h
(2 SWS Supervised exercise (UE) "Introduction to MATLAB" Total workload 90h: 28h contact / 62h practising learned programming skills)

Used in course of study
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Contact person
Module responsibility
- Carsten Gießing
Authorized examiners
- Carsten Gießing

Entry requirements

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

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

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

Reader's advisory

Links

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)

Modullevel
MM (Mastermodul / Master module)

Modulart
Wahlpflicht / Elective

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination

Time of examination
end of summer term

Type of examination
Working on exercises
Regular active participation

Course type
Comment
SWS
Frequency
Workload attendance

Lecture
0.00
SuSe
0 h

Seminar
0.00
SuSe
0 h

Exercises
2.00
SuSe
28 h

Total time of attendance for the module
28 h
Module label: International Meeting Contribution

Module code: neu810

Credit points: 3.0 KP

Workload: 90 h

Used in course of study:
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Biology (Master) > Skills Modules
- Master's Programme Neuroscience (Master) > Skills Modules

Contact person:
- Module responsibility:
  - Jutta Kretzberg
- Authorized examiners:
  - Jutta Kretzberg
  - Christine Köpp
  - Jannis Hildebrandt

Entry requirements:
- + Neurosci. knowlg.
- ++ Independent research
- ++ Scient. Literature
- ++ Social skills
- + Interdiscipl. knowlg.
- ++ Data present./disc.
- + Scientific English
- ++ Ethics

Skills to be acquired in this module:
- Presentation and critical discussion of own studies in front of an international audience:
  - participate in an international meeting
  - prepare a poster or talk for an international meeting
  - present own results in a way that is appropriate for the target audience
  - put own studies into the context of scientific literature
  - acquire additional knowledge about a broader field of research

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.

Reader's advisory:
- dependent on the scientific topic

Links:
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: every semester, flexible
- Module capacity: unlimited (please contact module organizer individually)
- Modullevel: MM (Mastermodul / Master module)
- Modulart: Wahlpflicht / Elective
- Lern-/Lehrform / Type of program:
- Vorkenntnisse / Previous knowledge:
- Examination:
- Time of examination: none (only pass/fail)
- Type of examination: Seminar

Course type:
- SWS: 0.00
- Frequency: SuSe and WiSe
- Workload attendance: 0 h
## Abschlussmodul
**mam - Master´s Thesis Module**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Master´s Thesis Module</th>
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<tr>
<td>Module code</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>900 h</td>
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<td>Master's Programme Biology (Master) &gt; Abschlussmodul</td>
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<td>Contact person</td>
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<td>Module responsibility</td>
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<td>Lehrende der Biologie</td>
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<td>Authorized examiners</td>
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<td>Lehrende der Biologie</td>
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### Contact person

**Module responsibility**

- Lehrende der Biologie
- Authorized examiners
- Lehrende der Biologie

### Entry requirements

**Skills to be acquired in this module**

- 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 in German and English (written and spoken)
- teamwork
- ethics and professional behaviour
- project and time management

### Module contents

Preparing the Master thesis

Active participation in the seminar of the research group, in which the Master thesis is written

### Reader's advisory

Supervisors may supply an initial reading list with important literature. The students are expected to find and use further literature as needed.

### Links

**Languages of instruction**

- English
- German

**Duration (semesters)**

1 Semester

**Module frequency**

Semiannual

**Module capacity**

Unlimited

**Modullevel**

MM (Mastermodul / Master module)

**Modulart**

Pflicht / Mandatory

### Lern-/Lehrform / Type of program

**Vorkenntnisse / Previous knowledge**

### Examination

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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>master's thesis (90%)</td>
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<td>Final colloquium (10%)</td>
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### Course type

Seminar

### SWS

2.00

### Frequency

SuSe and WiSe

### Workload attendance

28 h