Modules for Neurosensory Science and Systems

Module

olt133 - Language courses

Module label
Language courses

Module code
olt133

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Structured Doctoral Programme Environmental Sciences and Biodiversity (Doctoral Programme) > Module
- Structured Doctoral Programme Interface Science (Doctoral Programme) > Module
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

Contact person
Module responsibility
- Klaudia Hettwer

Entry requirements

Skills to be acquired in this module
Development and/or improvement of language skills.

Module contents
The PhD student should improve his or her language skills in a language not being his or her mother tongue. If the student is going for a lab visit abroad other languages than English or German can be chosen.

Reader's advisory

Links

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel
Prom (Promotion)

Modulart
Wahlpflicht / Elective

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination
Time of examination
Type of examination

Final exam of module
Active participation

Course type
VA-Auswahl

SWS
0.00

Frequency
SuSe and WiSe

Workload attendance
0 h
**olt134 - Additional module in communication**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Additional module in communication</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>olt134</td>
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<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Klaudia Hettwer</td>
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<tr>
<td>Entry requirements</td>
<td></td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td></td>
</tr>
<tr>
<td>Module contents</td>
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<td>Reader's advisory</td>
<td></td>
</tr>
<tr>
<td>Languages of instruction</td>
<td>English , German</td>
</tr>
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<td>Duration (semesters)</td>
<td>1 Semester</td>
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<td>Module frequency</td>
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<td>Modulart</td>
<td>Wahlpflicht / Elective</td>
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**Lern-/Lehrform / Type of program**

<table>
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**Vorkenntnisse / Previous knowledge**

<table>
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<th>Course type</th>
<th>VA-Auswahl</th>
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<td>Frequency</td>
<td>SuSe and WiSe</td>
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<tr>
<td>Workload attendance</td>
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</table>
### Module Information

**Module Code:** ol161  
**Module Label:** Transferable skills / Scientific career  
**Credit Points:** 12.0 KP  
**Workload:** 360 h

#### Used in course of study
- Structured Doctoral Programme Environmental Sciences and Biodiversity (Doctoral Programme) > Module
- Structured Doctoral Programme Interface Science (Doctoral Programme) > Module
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

#### Contact Person
- Module responsibility
  - Klaudia Hettwer

#### Entry Requirements
- Skills to be acquired in this module
- Reader's advisory

#### Module Contents
- Languages of Instruction: English, German
- Duration (semesters): 1 Semester

#### Module Frequency
- Module capacity: unlimited
- Module level: Prom (Promotion)
- Module art: Wahlpflicht / Elective

#### Learning/Teaching Form / Type of Program
- Lern-/Lehrform / Type of Program

#### Examination
- Examination
- Time of examination
- Type of examination
- Final exam of module
  - Active participation

#### Course Type
- Course type: VA-Auswahl

#### SWS
- SWS: 2.00

#### Frequency
- Frequency: SuSe and WiSe

#### Workload Attendance
- Workload attendance: 28 h
### Module Details

**Module label:** Mentoring  
**Module code:** olt164  
**Credit points:** 6.0 KP  
**Workload:** 180 h  
**Used in course of study:**  
- Structured Doctoral Programme Environmental Sciences and Biodiversity (Doctoral Programme) > Module  
- Structured Doctoral Programme Interface Science (Doctoral Programme) > Module  
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module  

**Contact person:** Module responsibility  
- Klaudia Hettwer

**Entry requirements:**

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

**Module contents:**

**Reader's advisory:**

**Languages of instruction:** German, English

**Duration (semesters):** 1 Semester

**Module frequency:***

**Module capacity:** unlimited

**Modullevel:** Prom (Promotion)

**Modulart:** Wahlpflicht / Elective

### Examination Details

<table>
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<th>Examination</th>
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**Course type:** VA-Auswahl

**SWS:** 0.00

**Frequency:** SuSe and WiSe

**Workload attendance:** 0 h
olt165 - Additional module "Transferable Skills"

<table>
<thead>
<tr>
<th>Module label</th>
<th>Additional module &quot;Transferable Skills&quot;</th>
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<tbody>
<tr>
<td>Module code</td>
<td>olt165</td>
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<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>

**Used in course of study**
- Structured Doctoral Programme Environmental Sciences and Biodiversity (Doctoral Programme) > Module
- Structured Doctoral Programme Interface Science (Doctoral Programme) > Module
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**
- Module responsibility
  - Klaudia Hettwer

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**
Development of additional and improved knowledge on transferable skills.

**Reader's advisory**

**Languages of instruction**
- German, English

**Duration (semesters)**
1 Semester

**Module frequency**
halbjährlich

**Module capacity**
unlimited

**Modullevel**
Prom (Promotion)

**Modulart**
Wahlpflicht / Elective

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

**Vorkenntnisse / Previous knowledge**

**Examination**
- Time of examination
- Type of examination
- Final exam of module
- Active participation

**Course type**
VA-Auswahl

**SWS**
0.00

**Frequency**
SuSe and WiSe

**Workload attendance**
0 h
## olt201 - Summer School / Congress

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>olt201</td>
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<tr>
<td>Workload</td>
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<tr>
<td>Contact person</td>
<td></td>
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<td>Module responsibility</td>
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<tr>
<td></td>
<td>→ Georg Martin Klump</td>
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<tr>
<td></td>
<td>→ Henrik Mouritsen</td>
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<td>Module counseling</td>
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<td></td>
<td>→ Klaudia Hettwer</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>English language skills; Presentation skills;</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Development of competence in the presentation and discussion of research findings in the international context. Obtaining an overview of related research fields. Social skills (networking) in the international scientific community should be developed.</td>
</tr>
<tr>
<td>Module contents</td>
<td>The PhD students participate at summer schools or international congresses. They prepare their own presentation, show their work in the form of posters or oral presentations and discuss their findings with an audience. Since the participation at summer schools and workshops includes the cooperation with scientists from other national and/or international research institutions, the students extend their knowledge and socialise with the scientific community.</td>
</tr>
</tbody>
</table>

### Reader’s advisory

**Links**

- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: unregelmäßig
- Module capacity: unlimited
- Modullevel: Prom (Promotion)
- Modulart: Wahlpflicht / Elective

**Vorkenntnisse / Previous knowledge**

**Examination**

- Time of examination
- Type of examination
- Final exam of module
  - at congresses: active participation with poster presentation and/or talk
  - at summer schools: active participation

**Course type**

<table>
<thead>
<tr>
<th>Course type</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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<td>SuSe and WiSe</td>
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<tr>
<td>VA-Auswahl</td>
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<td>0.00</td>
<td>WiSe</td>
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**Total time of attendance for the module**

28 h
## olt202 - Lab visit abroad

<table>
<thead>
<tr>
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<tr>
<td>Workload</td>
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<tr>
<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Georg Martin Klump</td>
</tr>
</tbody>
</table>

### Entry requirements

- **Skills to be acquired in this module**: Development of competence in working in a foreign laboratory or in the field to extend and improve knowledge on sampling and analysis methods with adequate technologies. In addition, social skills (networking, teamwork, cross-cultural competence) should be developed.

### Module contents

- The PhD students plan their schedule, prepare their practical work and organize their stay at the laboratory of a foreign research institution.

### Reader's advisory

- Please plan the research trip in time.

### Languages of instruction

- **Duration (semesters)**: 1 Semester
- **Module frequency**: halbjährlich
- **Module capacity**: unlimited

### Reference text

- Please plan the research trip in time.

### Lern-/Lehrform / Type of program

- **Modullevel**: Prom (Promotion)
- **Modulart**: je nach Studiengang Pflicht oder Wahlpflicht

### Examination / Previous knowledge

<table>
<thead>
<tr>
<th>Examination</th>
<th>Time of examination</th>
<th>Type of examination</th>
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<tbody>
<tr>
<td>Final exam of module</td>
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<td>oral or written report</td>
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</table>

### Course type

- VA-Auswahl

### SWS

- 0.00

### Frequency

- --

### Workload attendance

- 0 h
olt203 - Special techniques in Neurosensory Science and Systems

Module label
Special techniques in Neurosensory Science and Systems

Module code
olt203

Credit points
12.0 KP

Workload
360 h

Used in course of study
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

Contact person
Module responsibility
- Georg Martin Klump

Entry requirements

Skills to be acquired in this module
Development of improved or additional competences in special scientific techniques including laboratory methodologies as well as analysing, modelling and interpreting data.

This Module will introduce the recommendations on good scientific practice of the German Science Foundation (DFG), and the official procedures for dealing with scientific misconduct at the University of Oldenburg.

Module contents
The PhD students extend their knowledge on special scientific techniques or good scientific practice through participating at advanced courses including lectures, seminars or intensive courses. Intensive courses can be part of a summer school.

Reader's advisory

Links

Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel
Prom (Promotion)

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
Active participation

Course type
VA-Auswahl

SWS
0.00

Frequency
--

Workload attendance
0 h
olt204 - Medical basics of Neurosensory Sciences and Systems

Module label
Medical basics of Neurosensory Sciences and Systems

Module code
olt204

Credit points
6.0 KP

Workload
180 h

Used in course of study
Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

Contact person
Module responsibility
Birger Kollmeier

Entry requirements

Skills to be acquired in this module
Development of additional and improved knowledge on numerous topics of scientific field of medicine. The knowledge of the medical bases of neurosensory should be developed.

Module contents

Reader's advisory

Links

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modulelevel
Prom (Promotion)

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
Active participation

Course type
VA-Auswahl

SWS
0.00

Frequency
--

Workload attendance
0 h
olt205 - Data analysis using Matlab

Module label: Data analysis using Matlab
Module code: olt205
Credit points: 3.0 KP
Workload: 90 h
Used in course of study: Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

Contact person:
Module responsibility:
  - Jutta Kretzberg

Entry requirements:
Skills to be acquired in this module:
Module contents:
Reader's advisory:

Links:
Languages of instruction: German, English
Duration (semesters): 1 Semester
Module frequency: halbjährlich
Module capacity: unlimited
Module level: Prom (Promotion)
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:
Active participation:

Course type:
Seminar

SWS:
Frequency:
Workload attendance: 0 h
## olt206 - Journal club

<table>
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<tr>
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<th>Journal club</th>
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<tr>
<td>Workload</td>
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<td>Contact person</td>
<td>Module responsibility</td>
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<tr>
<td></td>
<td>Karl-Wilhelm Koch</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>English language skills</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Development of additional and improved knowledge on specific research areas. Competences in discussing scientific topics and the general outline of a scientific publication should be developed.</td>
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<tr>
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<td>Reader's advisory</td>
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<td>Modullevel</td>
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<td>je nach Studiengang Pflicht oder Wahlpflicht</td>
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<td>Lern-/Lehrform / Type of program</td>
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<td>Examination</td>
<td>Time of examination</td>
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<tr>
<td>Workload attendance</td>
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olt207 - Colloquium Neurosensory Science and Systems

Module label: Colloquium Neurosensory Science and Systems  
Module code: olt207  
Credit points: 3.0 KP  
Workload: 90 h  
Used in course of study: Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

Contact person:  
Module responsibility  
- Georg Martin Klump  
- Birger Kollmeier  
- Kathrin Henrichs  
- Beate Grünberg

Entry requirements

Skills to be acquired in this module: Development of scientific knowledge, networking skills and presentation skills.

Module contents: PhD Students present their research topics and results to other PhD Students and discuss them. PhD Students participate in research seminars and get insight in current research topics.

Reader's advisory

Links

Language of instruction: English  
Duration (semesters): 1 Semester  
Module frequency: halbjährlich  
Module capacity: unlimited  
Modullevel: Prom (Promotion)  
Modulart: je nach Studiengang Pflicht oder Wahlpflicht

Lern-/Lehrform / Type of program

Vorkenntnisse / Previous knowledge

Examination:  
Time of examination:  
Type of examination: SFB-Research seminar: Active participation  
Hot Topic Seminar and GK-Colloquium: Active participation with at least one talk or poster presentation

Course type: Seminar

SWS

Frequency

Workload attendance: 0 h
## Module Description

**Module label**: Additional module "Specific knowledge"

**Module code**: olt208

**Credit points**: 6.0 KP

**Workload**: 180 h

**Used in course of study**
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**

- Module responsibility
  - Kathrin Henrichs

**Entry requirements**

**Skills to be acquired in this module**

- Development of additional and improved knowledge on specific research areas.

**Module contents**

**Reader's advisory**

**Links**

**Languages of instruction**: German, English

**Duration (semesters)**: 1 Semester

**Module frequency**: halbjährlich

**Module capacity**: unlimited

**Reference text**: Courses of the modules olt201-olt207 or comparable courses can be accepted

**Modullevel**: Prom (Promotion)

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

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

**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
<thead>
<tr>
<th>Time of examination</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>See description of the module, from which the course was chosen</td>
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**Course type**: VA-Auswahl

**SWS**: 0.00

**Frequency**: --

**Workload attendance**: 0 h
**olt231 - Advanced presentation techniques**

**Module label**  
Advanced presentation techniques

**Module code**  
olt231

**Credit points**  
3.0 KP

**Workload**  
90 h

**Used in course of study**  
- Structured Doctoral Programme Interface Science (Doctoral Programme) > Module
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**  
Module responsibility
- Henrik Mouritsen

**Entry requirements**  
English language skills; Software PowerPoint

**Skills to be acquired in this module**  
Development of competences in presenting scientific topics.

**Module contents**  
Courses on advanced presentation skills provide a practical opportunity to enhance current presentation skills and add finesse to the delivery of presentations. The training looks at how to make a presentation persuasive and includes structuring and designing of contributions for conferences, self-evaluation and body language. Other courses of this module focus on voice training for improving economic breathing and for generating an accurate pronunciation or on the formation of strategic networks in the community as key for successful careers in science and industry. The generation of knowledge on the use of special equipment and techniques or the design of a web page for presenting research findings are also included in this module.

**Reader’s advisory**

**Links**

**Languages of instruction**

**Duration (semesters)**  
1 Semester

**Module frequency**  
halbjährlich

**Module capacity**  
unlimited

**Modullevel**  
Prom (Promotion)

**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**  
Active participation: Assessment of a poster and/or assessment of two talks.

**Course type**  
VA-Auswahl

**SWS**  
0.00

**Frequency**  
WiSe

**Workload attendance**  
0 h
**olt232 - Summer School / Congress**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Summer School / Congress</th>
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</thead>
<tbody>
<tr>
<td>Module code</td>
<td>olt232</td>
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<tr>
<td>Credit points</td>
<td>4.0 KP</td>
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<tr>
<td>Workload</td>
<td>120 h</td>
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<td>Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) &gt; Module</td>
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<td>Contact person</td>
<td>Module responsibility</td>
</tr>
<tr>
<td></td>
<td>Georg Martin Klump</td>
</tr>
<tr>
<td></td>
<td>Henrik Mouritsen</td>
</tr>
<tr>
<td>Entry requirements</td>
<td>English language skills, presentation skills</td>
</tr>
<tr>
<td>Skills to be acquired in this module</td>
<td>Development of competence in the presentation and discussion of research findings in the international context. Obtaining an overview of related research fields. Social skills (networking) in the international scientific community should be developed.</td>
</tr>
<tr>
<td>Module contents</td>
<td>The PhD students participate at summer schools or international congresses. They prepare their own presentation, show their work in the form of posters or oral presentations and discuss their findings with an audience. Since the participation at summer schools and workshops includes the cooperation with scientists from other national and/or international research institutions, the students extend their knowledge and socialise with the scientific community.</td>
</tr>
</tbody>
</table>

**Reader's advisory**

**Links**

- **Language of instruction**: English
- **Duration (semesters)**: 1 Semester
- **Module frequency**: halbjährlich
- **Module capacity**: unlimited
- **Reference text**: Module should be attended: At any time of the PhD work
- **Modullevel**: Prom (Promotion)
- **Lern-/Lehrform / Type of program**
- **Vorkenntnisse / Previous knowledge**
- **Final exam of module**
- **Course type**: VA-Auswahl
- **SWS**: 0.00
- **Frequency**: --
- **Workload attendance**: 0 h

**Type of examination**

- at congresses: active participation with posterpresentation and/or talk
- at summer schools: active participation
## olt233 - Didactics

<table>
<thead>
<tr>
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<th>Didactics</th>
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<tbody>
<tr>
<td>Module code</td>
<td>olt233</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Skills to be acquired in this module</td>
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</tr>
<tr>
<td>Module contents</td>
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<tr>
<td>Reader's advisory</td>
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<td>Links</td>
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<td>Module capacity</td>
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<tr>
<td>Module level</td>
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### Lern-/Lehrform / Type of program

<table>
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### SWS

<table>
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| Workload attendance | 0 h     |
### olt261 - Basics in distribution-free statistics

<table>
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<td>Module responsibility</td>
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<tr>
<td></td>
<td>• Georg Martin Klump</td>
</tr>
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<td>• Ulrike Langemann</td>
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<td>Skills to be acquired in this module</td>
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<td>Module contents</td>
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**olt262 - Experimental design and variance analysis**

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**Used in course of study**
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**
- Module responsibility
  - Hans Colonius

**Entry requirements**

**Skills to be acquired in this module**

- Students should:
  - understand the basic logic of statistical inference and experimental designs
  - and be able to correctly interpret empirical statistical results;
  - become familiar with the most common types of analysis of variance and experimental designs,
  - be able to develop an appropriate experimental design for a given research question,
  - and be able to correctly perform the statistical analyses of empirical data.

**Module contents**

- Principles of statistical inference, principals of analysis of variance;
- Contrasts and comparisons among means; single- and two-factor independent group designs; repeated measures designs; multivariate statistical methods
- Lecturers give input on basic and special topics of experimental designs and analysis of variance
- Data are analysed in class using SPSS and/or R.
- Students work in groups in order to prepare a statistical analysis on self-collected data. This is presented and the analysis is carried out by the participants in class.

**Reader’s advisory**

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Language of instruction**
- halbjährlich

**Module capacity**
- unlimited

**Modullevel**
- Prom (Promotion)

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

**Lern-Lehrform / Type of program**

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Total time of attendance for the module**
- 56 h
**olt263 - Numeric and computer Skills**

<table>
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<td>Contact person</td>
<td>Module responsibility</td>
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<td></td>
<td>Volker Hohmann</td>
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**Entry requirements**

- Students acquire theoretical knowledge of basic numerical methods and practical skills to apply these methods on physical problems within all areas of experimental, theoretical and applied physics.

**Module contents**

- Basic concepts of numerical mathematics are introduced and applied to physics problems. Topics include: finite number representation and numerical errors linear and nonlinear systems of equations numerical differentiation and integration function minimization and model fitting discrete Fourier analysis ordinary and partial differential equations.

**Reader's advisory**

**Language of instruction**

- German

**Duration (semesters)**

- 1 Semester

**Module frequency**

- unlimited

**Reference text**

- Language: English materials, including extensive script;, tutorials in English; lecture in German
- Module should be attended: At any time during the PhD project

**Modullevel**

- Prom (Promotion)

**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**

- Active participation

**Course type**

- VA-Auswahl

**SWS**

- 0.00

**Frequency**

- --

**Workload attendance**

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**Used in course of study**
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**
- Module responsibility
  - Christiane Margarete Thiel
- Module counseling
  - Georg Martin Klump
  - Birger Kollmeier
  - Steven van de Par

**Entry requirements**
- English language skills, PhD Students should have data to publish.

**Skills to be acquired in this module**
- Development of competences in scientific writing for publishing in international peer-reviewed scientific journal.

**Module contents**
The students learn about the importance and structure of scientific publications. For writing their own (first) publication the PhD Students work together in tandems, small teams or intensive writing classes.

**Reader's advisory**

**Links**

**Language of instruction**
- English

**Duration (semesters)**
- 1 Semester

**Module frequency**
- halbjährlich

**Module capacity**
- unlimited

**Reference text**
- Events of this module including dates and locations: According to agreement with lecturers

**Modullevel**
- Prom (Promotion)

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

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

**Vorkenntnisse / Previous knowledge**

**Examination**

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**Course type**
- Seminar

**SWS**

**Frequency**

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# Laboratory Animal Science

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**Used in course of study**
- Structured Doctoral Programme Neurosensory Science and Systems (Doctoral Programme) > Module

**Contact person**

**Entry requirements**

**Skills to be acquired in this module**

**Module contents**

**Reader's advisory**

**Links**

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**Type of program**

**Previous knowledge**

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