Modules for Molecular Biomedicine

Background Modules

bio605 - Molecular Genetics and Cell Biology

<table>
<thead>
<tr>
<th>Module label</th>
<th>Molecular Genetics and Cell Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>bio605</td>
</tr>
<tr>
<td>Credit points</td>
<td>12.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>360 h</td>
</tr>
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Verwendbarkeit des Moduls
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Zuständige Personen
- Neidhardt, John (module responsibility)
- Neidhardt, John (Prüfungsberechtigt)
- Koch, Karl-Wilhelm (Prüfungsberechtigt)
- Jüschke, Christoph (Prüfungsberechtigt)

Prerequisites
- BSc (Biologie, Biochemie)

Skills to be acquired in this module
++ deepened biological expertise
++ deepened knowledge of biological working methods
+ data analysis skills
+ interdisciplinary thinking
+ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ data presentation and discussion (E) (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.

Literaturempfehlungen
Textbooks of Cell Biology

Links
http://www.uni-oldenburg.de/humangenetik/

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency

Module capacity
15

Reference text
associated with bio900

Modullevel / module level

Modulart / typ of module

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

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

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance
Lecture
2
WiSe
28
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<thead>
<tr>
<th>Form of instruction</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Seminar</td>
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<td>1</td>
<td>WiSe</td>
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<tr>
<td>Exercises</td>
<td></td>
<td>5</td>
<td>WiSe</td>
<td>70</td>
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<tr>
<td><strong>Präsenzzeit Modul insgesamt</strong></td>
<td></td>
<td></td>
<td></td>
<td>112 h</td>
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</table>
bio695 - Biochemical concepts in signal transduction

Module label: Biochemical concepts in signal transduction

Modulkürzel: bio695

Credit points: 12.0 KP

Workload: 360 h

Verwendbarkeit des Moduls:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Zuständige Personen:
- Koch, Karl-Wilhelm (module responsibility)
- Koch, Karl-Wilhelm (Prüfungsberechtigt)
- Scholten, Alexander (Prüfungsberechtigt)
- Scholten, Alexander (Module counselling)

Prerequisites:
- keine

Skills to be acquired in this module:
++ deepened knowledge of biological working methods
++ methods: protein expression and purification, functional assays, enzyme kinetics, spectroscopic techniques
++ 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
+ 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

Literaturempfehlungen:
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: 1 Semester

Module capacity: 20

Modulart / typ of module:

Lehr-/Lernform / Teaching/Learning method:

Vorkenntnisse / Previous knowledge:

Examination:
Prüfungszeiten: 90 minutes written exam
Type of examination: written examination (50%) protocols (50%)
Prerequisite for passing the module is active participation: Presentation(s) in the seminar

Form of instruction:
- Lecture: SWS = 1, Frequency = WiSe, Workload of compulsory attendance = 14
- Seminar: SWS = 1, Frequency = WiSe, Workload of compulsory attendance = 14
- Exercises: SWS = 6, Frequency = WiSe, Workload of compulsory attendance = 84

Präsenzzeit Modul insgesamt: 112 h
### gsw010 - Molecular Physiology

<table>
<thead>
<tr>
<th>Module label</th>
<th>Molecular Physiology</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw010</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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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>- Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>- Milenkovic, Ivan (module responsibility)</td>
</tr>
<tr>
<td></td>
<td>- Milenkovic, Ivan (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>- Radulovic, Tamara (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>- Keine, Christian (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>- Radulovic, Tamara (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>- Milenkovic, Ivan (Module counselling)</td>
</tr>
</tbody>
</table>

#### Prerequisites
- Enrolment in Master’s programme Molecular Biomedicine;
- Knowledge of cell biology is beneficial for comprehension of lecture content

#### Skills to be acquired in this module
**Goals of the Module:**
- know molecular mechanisms of cellular physiology
- know physiology of the following human body organ systems: muscular system, nervous system, cardiovascular system, respiratory system, urinary system
- understand pathophysiology of certain diseases
- know basic principles of functional tests for certain organ systems.

**Competencies:**
- deepened biological expertise
- deepened clinical/pathological expertise
- deepened knowledge of medical diagnostic methods
- data analysis and clinical interpretation
- interdisciplinary thinking

#### Module contents
The module focuses on physiology of the cell, physiology of human organ systems in health and disease, homeostatic regulation mechanisms

**Lecture topics:**
1. Cellular mechanisms of excitability
2. Synaptic transmission
3. Muscle contraction
4. Spinal cord reflexes
5. Motor skills
6. Basic principles of circulatory function
7. Pulmonary ventilation
8. Regulation of respiration
9. General sensory physiology
10. Physiology of special senses
11. Kidneys
12. Water homeostasis and osmoregulation

**Exercise:**
1. Excitability of nerve cells and AP propagation
2. Reflexes
3. Electrocardiography
4. Pulmonary function tests and regulation of respiration
5. Functional tests for sensory systems
6. Water and osmolarity homeostasis

#### Literatureempfehlungen
Guyton and Hall - Textbook of medical physiology (covers most topics)
Kandler, Schwarz, Jessell - Principles of neural science
Gary G. Matthews – Cellular Physiology of Nerve and Muscle

#### Links
https://uol.de/physiologie

#### Language of instruction
English

#### Duration (semesters)
1 Semester

#### Module frequency
winter and summer semester

#### Module capacity
10 (participation at lectures is not restricted)

#### Reference text
The number of participants for the practical part of this module is limited to 10. Students which are enrolled in Master’s programme Molecular Biomedicine will be preferred.

#### Modullevel / module level
MM (Mastermodul / Master module)
<table>
<thead>
<tr>
<th>Modulart / typ of module</th>
<th>Wahlpflicht / Elective</th>
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<tbody>
<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>Basic knowledge in physiology and cell biology</td>
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<tr>
<td>Examination</td>
<td>Prüfungszeiten</td>
</tr>
<tr>
<td>Final exam of module</td>
<td>Oral examination (20 min.)</td>
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<tr>
<td>Form of instruction</td>
<td>Comment</td>
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<tr>
<td>Lecture</td>
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<td>Practical training</td>
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<tr>
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<td>56 h</td>
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**gsw020 - Cellular and Subcellular Structures**

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<th>Cellular and Subcellular Structures</th>
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<tr>
<td>Modulkürzel</td>
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<tr>
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<tr>
<td>Workload</td>
<td>180 h</td>
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**Verwendbarkeit des Moduls**
- Master's Programme Molecular Biomedicine (Master) > Background Modules

**Zuständige Personen**
- Bräuer, Anja (module responsibility)
- Bräuer, Anja (Prüfungsberechtigt)
- Maier, Esther Christine (Prüfungsberechtigt)
- Maier, Esther Christine (Module counselling)

**Prerequisites**
Enrolment in Master’s programme Molecular Biomedicine

**Skills to be acquired in this module**

**Goals of the Module:**
Upon successful completion of this module, students know and understand cellular and subcellular structures and their function in the human body.

**Competencies:**
++ deepened biological expertise
++ deepened clinical / pathological expertise,
++ deepened knowledge of biological working methods
++ deepened knowledge of clinical / pathological diagnostics,
+ interdisciplinary thinking,
+ critical and analytical thinking,
+ ability to perform independent biological research
+ ethics and professional behaviour

**Module contents**
The module aims to give students an insight into microscopic functional anatomy. In this module, we will cover aspects of cell compartmentalisation and tissue organisation as the basis for normal function and homeostasis. In addition, we will cover examples of organ organisation and organ function. To introduce students to clinical concepts and to deepen their understanding of the functional roles of cells and tissues, we will also cover aspects of the pathological basis of disease for selected organs and organelles.

In the accompanying seminar, students will have the chance to work on light and electron microscopic pictures, to practice annotation and identification of cells and tissues. In addition, the students will read and present original literature. This will introduce select aspects of disease, but also introduce research methodology and scientific thinking.

This course is **not** a full histology course, but it serves as an introduction to the topic, recapitulates aspects of cell biology and introduces a few select aspects of pathology. Thus, this module is aimed at students with little experience in cell biology.

**Literatureempfehlungen**
Molecular Biology of the Cell (Alberts et al., 6th ed.)
Junqueira’s Basic Histology: Text and Atlas (Mescher, 14th ed.)
Robbins Basic Pathology (Kumar et al., 9th ed.)

**Links**
https://uol.de/anatomie/forschung/

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
summer semester

**Module capacity**
25

**Reference text**
For your notice: this course will **NOT** cover microscopic imaging techniques, if you are interested please see module gsw200_Microscopic Imaging in Biomedical Sciences.

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

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

**Lehr-/Lernform / Teaching/Learning method**
Lecture and Seminar

**Vorkenntnisse / Previous knowledge**
Basic knowledge in biology, chemistry, mathematics

**Examination**
Prüfungszeiten
type of examination

**Final exam of module**
written examination (45 min.)
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<th>SWS</th>
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<th>Workload of compulsory attendance</th>
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<tbody>
<tr>
<td>Lecture</td>
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<td>2</td>
<td>SoSe</td>
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<tr>
<td>Exercises</td>
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<td>2</td>
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<td><strong>Präsenzzeit Modul insgesamt</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>56 h</strong></td>
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gsw030 - Biophysical Chemistry

Module label: Biophysical Chemistry
Modulkürzel: gsw030
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Molecular Biomedicine (Master) > Background Modules

Zuständige Personen:
- Winklhofer, Michael (module responsibility)
- Winklhofer, Michael (Prüfungsberechtigt)

Prerequisites:
Enrolment in Master’s programme Molecular Biomedicine

Skills to be acquired in this module:
Goals of the Module:
Upon successful completion of this module, students understand physical principles underlying biochemistry and cell biology.

Competencies:
++ deepened biological expertise
+ data analysis skills
+ usage of databases and computational tools
+ interdisciplinary thinking
++ critical and analytical thinking
++ data presentation and discussion

Module contents:
The module focuses on molecular biophysics, biophysical chemistry, biochemistry, cell biology.

Dynamics of single molecules, molecular thermodynamics, statistical thermodynamics; diffusion; chemical equilibria involving macromolecules, signal amplification; spectroscopical techniques (molecular vibration and rotation spectroscopy, electronic absorption and fluorescence spectroscopy, FRET, NMR, Atomic force microscopy).

Literaturempfehlungen:
- Principles of Biophysical Chemistry (van Holde et al., Pearson/Prentice Hall)
- Physical chemistry (Atkins, Wiley VCH)
- Biophysics - Searching for principles (Bialek, Princeton UP)

Links:
https://uol.de/en/biology/groups-our-research/sensory-biology-of-animals
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: summer semester
Module capacity: 20
Modullevel / module level: MM (Mastermodul / Master module)
Modulart / typ of module: Wahlpflicht / Elective

Vorkenntnisse / Previous knowledge:
basic knowledge in biochemistry and physics

Form of instruction: Lecture and Seminar

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<tr>
<th>Form of instruction</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Lecture</td>
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<td>SoSe</td>
<td>28</td>
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<tr>
<td>Seminar</td>
<td>2</td>
<td>SoSe</td>
<td>28</td>
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Präsenzzeit Modul insgesamt: 56 h
# gsw040 - Molecular and Cellular Biology of Hearing and Deafness

<table>
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<th>Molecular and Cellular Biology of Hearing and Deafness</th>
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<td>gsw040</td>
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<tr>
<td>Credit points</td>
<td>12.0 KP</td>
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<tr>
<td>Workload</td>
<td>360 h</td>
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<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
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<tr>
<td>Zuständige Personen</td>
<td>Claußen, Maike (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Ebbers, Lena (Prüfungsberechtigt)</td>
</tr>
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<td>Ebbers, Lena (module responsibility)</td>
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<td>Claußen, Maike (module responsibility)</td>
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<td>Prerequisites</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>Competencies:</td>
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<tr>
<td></td>
<td>++ deepened biological expertise</td>
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<td>++ deepened knowledge of biological working methods</td>
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<tr>
<td></td>
<td>++ data analysis skills</td>
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<tr>
<td></td>
<td>+ interdisciplinary thinking</td>
</tr>
<tr>
<td></td>
<td>++ critical and analytical thinking</td>
</tr>
<tr>
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<td>++ independent searching and knowledge of scientific literature</td>
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<td>+ data presentation and discussion (written and spoken)</td>
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<tr>
<td>Module contents</td>
<td>The module focuses on auditory neuroscience, molecular and cellular neurobiology.</td>
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<tr>
<td></td>
<td><strong>Lecture:</strong> Development, anatomy and function of the auditory system (cochlea to cortex), classification, molecular causes and inheritance of auditory disorders, investigation of these disorders in animal models, insights into possibilities of treatment/therapy</td>
</tr>
<tr>
<td></td>
<td><strong>Seminar:</strong> The seminar will focus on possibilities of treatment options in the field of auditory rehabilitation. In a flipped classroom, students will shortly present and discuss different approaches.</td>
</tr>
<tr>
<td></td>
<td><strong>Exercise:</strong> Laboratory experiments to study mouse models of deafness/auditory processing disorders</td>
</tr>
<tr>
<td>Literaturempfehlungen</td>
<td>Springer Handbook of Auditory Research Series Vol. 63:</td>
</tr>
<tr>
<td></td>
<td>Vona, B., Haaf, T. (Eds.), &quot;Genetics of Deafness&quot;, 2016, Karger Publishers</td>
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<tr>
<td>Links</td>
<td><a href="https://uol.de/en/neurogenetics/research/">https://uol.de/en/neurogenetics/research/</a></td>
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<tr>
<td>Language of instruction</td>
<td>English</td>
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<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
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<tr>
<td>Module frequency</td>
<td>Second half of the summer semester</td>
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<tr>
<td>Module capacity</td>
<td>8</td>
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<tr>
<td>Reference text</td>
<td>The number of participants for this module is limited to 8. If there are more students registered than places available, lots will be drawn. Students which are enrolled in Master’s programme Molecular Biomedicine will be preferred.</td>
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<tr>
<td>Modullevel / module level</td>
<td>MM (Mastermodul / Master module)</td>
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<tr>
<td>Modulart / type of module</td>
<td>Wahlpflicht / Elective</td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
<td>Lecture, Seminar and Exercise</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td>basic knowledge in genetics, molecular biology and cell biology</td>
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<tr>
<td>Examination</td>
<td>Prüfungszeiten</td>
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<tr>
<td>Type of examination</td>
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<tr>
<td>Form of instruction</td>
<td>Comment</td>
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<tr>
<td>Lecture</td>
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<td>Seminar</td>
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<td>Practical training</td>
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<tr>
<td><strong>Präsenzzeit Modul insgesamt</strong></td>
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</table>
**gsw050 - Current Topics of Genetics**

**Module label**: Current Topics of Genetics

**Modulkürzel**: gsw050

**Credit points**: 6.0 KP

**Workload**: 180 h

**Verwendbarkeit des Moduls**
- Master's Programme Molecular Biomedicine (Master) > Background Modules

**Zuständige Personen**
- Ebbers, Lena (Prüfungsberechtigt)
- Ebbers, Lena (module responsibility)

**Prerequisites**
- Enrolment in Master’s programme Molecular Biomedicine

**Skills to be acquired in this module**

**Competencies**:
- ++ 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 (written and spoken)
- + team work

**Module contents**

**Lecture**: imparting of newest methods and "Hot Topics" in genetics (epigenetics, non-coding RNAs (also with reference to associated diseases)), genome editing, prospects and limitations of studying animal models/organoid cultures of human genetic disease, gene therapy, etc.

**Seminar**: reading/analyzing current literature in the field

**Literaturempfehlungen**
- Klug, Cummings, Spencer, Palladio, Killian, "Concepts of Genetics", Pearson, 2019
- Strachan and Read, "Human molecular genetics", CRC Press, 2019
- Current publications in genetics journals (e.g. Frontiers in Genetics, Trends in Genetics, PLOS Genetics, Nature Genetics, etc.)

**Links**
- https://uol.de/en/neurogenetics/research/

**Language of instruction**: English

**Duration (semesters)**
- 1 Semester

**Module frequency**: Second half of the winter semester

**Module capacity**: 20

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

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

**Lehr-/Lernform / Teaching/Learning method**: Lecture and Seminar

**Vorkenntnisse / Previous knowledge**: basic knowledge in genetics

**Examination**

**Prüfungszeiten**: graded: written examination (50%), portfolio (50%, concept paper and short presentation), ungraded: technical implementation of the concept paper (production of digital content for science communication (video/podcast))

**Form of instruction**

<table>
<thead>
<tr>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>2</td>
<td>SoSe</td>
<td>28</td>
</tr>
<tr>
<td>Seminar</td>
<td>2</td>
<td>SoSe</td>
<td>28</td>
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</table>

**Präsenzzeit Modul insgesamt**: 56 h
neu141 - Visual Neuroscience - Physiology and Anatomy

Module label: Visual Neuroscience - Physiology and Anatomy

Modulkürzel: 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

Verwendbarkeit des Moduls:
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Zuständige Personen:
- Greschner, Martin (module responsibility)
- Greschner, Martin (Prüfungsberechtigt)
- Ahlers, Malte (Prüfungsberechtigt)
- Dedek, Karin (Prüfungsberechtigt)
- Dömer, Patrick (Prüfungsberechtigt)

Prerequisites:
- 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

Literatureempfehlungen:
- 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.

<table>
<thead>
<tr>
<th>Links</th>
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<tbody>
<tr>
<td>Language of instruction</td>
</tr>
<tr>
<td>Duration (semesters)</td>
</tr>
<tr>
<td>Module frequency</td>
</tr>
<tr>
<td>Module capacity</td>
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</tbody>
</table>

| Module level / module level |

| Modulart / typ of module |

| Lehr-/Lernform / Teaching/Learning method |

| Vorkenntnisse / Previous knowledge |

<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>during the course (summer semester, first half) In addition, mandatory but ungraded: seminar presentation</td>
<td>PF</td>
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</table>

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
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<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>2</td>
<td>SoSe oder WiSe</td>
<td>28</td>
</tr>
<tr>
<td>Seminar</td>
<td></td>
<td>2</td>
<td>SoSe oder WiSe</td>
<td>28</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>2</td>
<td>SoSe oder WiSe</td>
<td>28</td>
</tr>
</tbody>
</table>

| Präsenzzeit Modul insgesamt | 84 h |
**neu150 - Visual Neuroscience - Anatomy**

<table>
<thead>
<tr>
<th>Module label</th>
<th>Visual Neuroscience - Anatomy</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>neu150</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
</tr>
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</table>

**Verwendbarkeit des Moduls**
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

**Zuständige Personen**
- Janssen-Bienhold, Ulrike (module responsibility)
- Dedek, Karin (Module counselling)
- Janssen-Bienhold, Ulrike (Prüfungsberechtigt)
- Dedek, Karin (Prüfungsberechtigt)
- Ahlers, Malte (Prüfungsberechtigt)

**Prerequisites**
attendance in pre-meeting

**Skills to be acquired in this module**
- Neurosci. knowlg. Expt. methods
- Independent research + Scient. literature + Social skills
- Interdiscipl. knowlg. Maths/Stats/Progr. + Data present./disc. + Scientific English Ethics
- Theory: Improved theoretical and methodological knowledge in neurobiology.
- Discussion of scientific work and presentation of own results.
- Practice: Performing 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.

**Literaturrempfehlungen**
Background and seminar literature will be available in Stud.IP

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
jährlich

**Module capacity**
unlimited

**Reference text**
Course in the first half of the semester
Regular active participation and presentation(s) within the scope of the seminar are required to pass the module

**Modullevel / module level**

**Modulart / typ of module**

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

**Vorkenntnisse / Previous knowledge**

**Examination**
Prüfungszeiten
Type of examination

**Final exam of module**
summer semester, first half
Portfolio (75 %), report (25 %)

<table>
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<th>Workload of compulsory attendance</th>
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<tr>
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<td>SoSe</td>
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<tr>
<td>Seminar</td>
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<td>SoSe</td>
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<tr>
<td>Practical training</td>
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<td>42</td>
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</table>

**Präsenzzeit Modul insgesamt**
70 h
neu220 - Neurocognition and Psychopharmacology

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<th>Module label</th>
<th>Neurocognition and Psychopharmacology</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
</tr>
</tbody>
</table>

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

Verwendbarkeit des Moduls
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

Zuständige Personen
- Thiel, Christiane Margarete (module responsibility)
- Thiel, Christiane Margarete (Module counselling)
- Thiel, Christiane Margarete (Prüfungsberechtigt)
- Gießing, Carsten (Prüfungsberechtigt)

Prerequisites

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

Upon successful completion of this course, students
- know the fundamentals of neurotransmission
- know the basic neural mechanisms underlying attention, learning, emotion, language and executive functions
- understand the relationship between disturbances in neurotransmitter systems, cognitive functions and psychiatric disease
- know the principles of drug treatment for psychiatric disorders
- have in-depth knowledge in selected areas of these topics
- are able to understand, explain and critically assess neuroscientific approaches in animals and humans
- are able to understand and critically assess published work in the area of cognitive neuroscience

Module contents
The lecture "Introduction to Cognitive Neuroscience" gives a short introduction into neuroanatomy and cognitive neuroscience methods and then covers different cognitive functions.

- History of cognitive neuroscience
- Methods of cognitive neuroscience
- Attention
- Learning
- Emotion
- Language
- Executive functions.

The supervised exercises either deepen that knowledge by exercises 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.

- 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

Literaturempfehlungen
<table>
<thead>
<tr>
<th>Links</th>
</tr>
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<tbody>
<tr>
<td>Language of instruction</td>
</tr>
<tr>
<td>Duration (semesters)</td>
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<tr>
<td>Module frequency</td>
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<tr>
<td>Module capacity</td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Course in the second half of the semester Regular active participation is required to pass the module.</td>
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<table>
<thead>
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<th>Modullevel / module level</th>
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<tbody>
<tr>
<td>Modulart / typ of module</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<th>Prüfungszeiten</th>
<th>Type of examination</th>
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<tr>
<td>Final exam of module</td>
<td>as agreed, usually in the break after the winter term</td>
<td>100% written exam (content of the lectures)</td>
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<td>42</td>
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<tr>
<th>Präsenzzeit Modul insgesamt</th>
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<tbody>
<tr>
<td>56 h</td>
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</table>
gsw230 - Molecular Pharmacology

Module label: Molecular Pharmacology
Modulkürzel: gsw230
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Molecular Biomedicine (Master) > Background Modules

Zuständige Personen:
- Rauch, Bernhard (module responsibility)
- Rauch, Bernhard (Prüfungsberechtigt)
- Meyer, Ulrike (Module counselling)

Prerequisites:
Enrolment in Master’s programme Molecular Biomedicine

Skills to be acquired in this module:
Goals of the module:
- upon completion of this module, students
- know about the subject of pharmacology in general, its areas of expertise such as pharmacokinetics and pharmacodynamics and their functions.
- understand on which pathophysiological mechanisms diseases are based and on which molecular targets pharmaceuticals act in order to alleviate diseases.
- know the basic actions and side effects of important drug groups.
- understand basic parameters of clinical studies and the importance of clinical studies for therapeutic approaches.

Skills to be acquired/ competencies:
++ deepened biological expertise
++ deepened clinical expertise
+ deepened knowledge of biological working methods
+ deepened knowledge of clinical diagnostics
+ data analysis skills
+ interdisciplinary thinking
+ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ data presentation and discussion (written and spoken)
+ teamwork
+ ethics and professional behavior

Module contents:
- Fundamentals of general pharmacology, its specialist areas such as pharmacokinetics and pharmacodynamics
- Explanation of the pathophysiological mechanisms of diseases and the corresponding molecular drugs targets
- Mechanisms of action and side effects of the major drug groups
- Knowledge of basic parameters of clinical studies and understanding of the importance of clinical studies for therapeutic approaches

Literaturempfehlungen:
- Basic & Clinical Pharmacology (Basic and Clinical Pharmacology), McGraw-Hill Education (2020)
- For German speaking students: Kurzlehrbuch Pharmakologie und Toxikologie, Herdegen, Thieme (2019)

Links:
Language of instruction: English
Duration (semesters): 2 Semester
Module frequency: winter term
Module capacity: 6 (Places are based on attended courses and given grades. Knowledge of physiology and biochemistry is required.)

Modullevel / module level
Modulart / typ of module
Lehr-/Lernform / Teaching/Learning method
Vorkenntnisse / Previous knowledge

Examination Prüfungszeiten Type of examination
Final exam of module written or oral exam: at the end of winter semester, written or oral examination (graded), protocol: at the end of the practical course protocol (ungraded)

Form of instruction Comment SWS Frequency Workload of compulsory attendance
Vorlesung und Seminar 2 WiSe 28
<table>
<thead>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Exercises</td>
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<td>2</td>
<td>SoSe</td>
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<tr>
<td><strong>Präsenzzeit Modul insgesamt</strong></td>
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<td></td>
<td></td>
<td>56 h</td>
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gsw240 - Basic Immunology in Health and Disease

<table>
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<th>Basic Immunology in Health and Disease</th>
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<td>Modulkürzel</td>
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<td>Credit points</td>
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<tr>
<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>• Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>• Loser, Karin (module responsibility)</td>
</tr>
<tr>
<td></td>
<td>• Loser, Karin (Prüfungsberechtigt)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>• Mykicki, Nadine (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Enrolment in Master’s programme Molecular Biomedicine</td>
</tr>
<tr>
<td></td>
<td>Basic knowledge in primary cell culture, quantitative real-time PCR, flow cytometry or histology would be highly desirable.</td>
</tr>
</tbody>
</table>

Skills to be acquired in this module

**Goals of this module:**
After completing this module, students are able to perform experimental approaches necessary to investigate selective immunological questions. These will comprise the normal function of the healthy immune system as well as processes leading to immune system dysregulation or immune system dysfunction in several systemic or organ specific diseases. Based on the basic knowledge of immunology acquired in the module students will be able to understand and analyze specific scientific problems, plan experimental approaches accordingly, and perform the experiments.

**Skills to be acquired/ competencies:**
++ Deepened biological expertise  
++ Deepened clinical expertise  
++ Deepened knowledge of biological working methods  
+ Deepened knowledge of clinical diagnostics  
++ 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 (written and spoken)  
+ Teamwork  
+ Project and time management

**Methods:**
Key methods learned and implemented in this module include  
- Primary cell culture and cell separation  
- RNA extraction, reverse transcription and quantitative real-time PCR  
- Tissue sectioning, immunohistology and immunofluorescence staining including microscopy  
- Multicolor flow cytometry  
- Quantification of soluble factors and inflammatory mediators using multiplex-assay techniques

<table>
<thead>
<tr>
<th>Module contents</th>
<th>Lecture:</th>
</tr>
</thead>
</table>
|                 | - Regulation of innate and adaptive immune responses in healthy individuals  
|                 | - Dysregulation of the immune system in inflammatory diseases, cancer or autoimmunity  
|                 | - Impact of the environment on immune regulation |

<table>
<thead>
<tr>
<th></th>
<th>Seminar:</th>
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<tbody>
<tr>
<td></td>
<td>- Presentation and discussion of laboratory methods used in the practical part</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Exercise:</th>
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<tbody>
<tr>
<td></td>
<td>This module involves working on small research projects in groups of 2-3 students. The projects include basic immunology in humans and mice with the goal of better understanding the development of allergy, sterile inflammation or autoimmunity as well as immune regulation during cancer or infection. Using the knowledge of immune regulation gained in the lecture and seminar, students will analyze and evaluate specific scientific problems. Required methods of immunology, cell and molecular biology (e.g., flow cytometry, cell separation, isolation and culture of primary immune cells, gene expression studies, histology) are taught and used.</td>
</tr>
</tbody>
</table>

| Literatureempfehlungen | Text books of Immunology including Janeway’s *Immunobiology* or Abbas et al. *Molecular and Cellular Immunology* |

<p>| Links | Language of instruction | English |</p>
<table>
<thead>
<tr>
<th>Duration (semesters)</th>
<th>1 Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module frequency</td>
<td>winter term</td>
</tr>
<tr>
<td>Module capacity</td>
<td>6 (Due to restrictions in space and limitations in equipment availability the number of participants for this module has to be limited. Students have to be enrolled in the Master’s program Molecular Biomedicine.)</td>
</tr>
</tbody>
</table>

**Reference text**: High priority is given to students of the Master’s program Molecular Biomedicine. In exceptional cases, vacancies may be allocated to Biology students. However, allocation to students not enrolled in the Master’s program Molecular Biomedicine can only be made by the lecturer(s) responsible for this module (personal application required).

**Module level / module level**

**Modulart / typ of module**

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

**Vorkenntnisse / Previous knowledge**

<table>
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<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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<tbody>
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<td>Final exam of module</td>
<td>After the end of the module.</td>
<td>50% presentation, 50% protocol</td>
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**Form of instruction** Seminar und Übung

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<tbody>
<tr>
<td>Frequency</td>
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<tr>
<td>Workload Präsenzzzeit</td>
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</table>
### gsw250 - Molecular Microbiology

<table>
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<tr>
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<tbody>
<tr>
<td>Modulkürzel</td>
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<td>Credit points</td>
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<td>Workload</td>
<td>180 h</td>
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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Background Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>Noster, Janina (module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Noster, Janina (Prüfungsberechtigt)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>Enrolment in Master’s programme Molecular Biomedicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills to be acquired in this module</td>
<td>Goals of this module: Upon completion of this module the students will have a basic knowledge about bacteriology, antibiotic resistances and gene mutagenesis methods.</td>
</tr>
<tr>
<td></td>
<td>Skills to be acquired/ competencies:</td>
</tr>
<tr>
<td></td>
<td>++ deepened biological expertise</td>
</tr>
<tr>
<td></td>
<td>++ deepened knowledge of biological working methods</td>
</tr>
<tr>
<td></td>
<td>+ deepened knowledge of clinical diagnostics</td>
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<tr>
<td></td>
<td>+ data analysis skills</td>
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<td>++ interdisciplinary thinking</td>
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<td>++ critical and analytical thinking</td>
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<td>++ independent searching and knowledge of scientific literature</td>
</tr>
<tr>
<td></td>
<td>++ data presentation and discussion (written and spoken)</td>
</tr>
<tr>
<td></td>
<td>+ teamwork + ethics and professional behavior</td>
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<tr>
<td></td>
<td>++ project and time management</td>
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</table>

| Module contents      | Lecture: In the first lectures, basic knowledge of general and specific bacteriology is taught. Subsequently, antibiotic resistance as well as resistance mechanisms are explained in more detail. Finally, the topic of horizontal gene transfer and mobile genetic elements will be discussed. |
|                     | Seminar: The seminar will address with the topic of antibiotic resistances. Students gain initial experience in formulating a scientific question and designing experiments to answer it. Different cloning strategies are discussed in detail. |
|                     | Practical course: The methods developed in the seminar will be put into practice. Antibiotic resistance plasmids will be modified using various techniques and the effects of these manipulations on bacterial physiology and resistance patterns will be investigated. |

| Literatureempfehlungen | Textbooks of microbiology. Current literature on antibiotic resistances and horizontal gene transfer will be announced in the lecture. |

<table>
<thead>
<tr>
<th>Links</th>
<th></th>
</tr>
</thead>
<tbody>
<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>winter term</td>
</tr>
<tr>
<td>Module capacity</td>
<td>6</td>
</tr>
</tbody>
</table>

| Reference text         | The lecture is held weekly during the semester (first half). Seminar and practical course form a joint block course. |

<table>
<thead>
<tr>
<th>Modullevel / module level</th>
<th></th>
</tr>
</thead>
<tbody>
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<td>Modulart / typ of module</td>
<td></td>
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<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
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<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
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<tbody>
<tr>
<td>Final exam of module</td>
<td>written examination: end of the module, presentation: during the seminar/practical course joint block, protocol: end of the practical course</td>
<td>graded: written examination, ungraded: presentation, protocols</td>
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<table>
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<th>Workload of compulsory attendance</th>
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<td>14</td>
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<tr>
<td>Seminar und Übung</td>
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<td>3</td>
<td>WiSe</td>
<td>42</td>
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<tr>
<td><strong>Präsenzzeit Modul insgesamt</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>56 h</strong></td>
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</tbody>
</table>
Molecular Virology

Module label: Molecular Virology
Modulkürzel: gsw260
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls:
- Master's Programme Molecular Biomedicine (Master) > Background Modules

Zuständige Personen:
- Kinast, Volker (module responsibility)
- Kinast, Volker (Prüfungsberechtigt)

Prerequisites

Goals of this module:
upon completion of this module, students
- know about general aspects of virology including the viral replication cycle, classification of viruses, virus-host-interactions, innate immune response and mechanisms of antiviral therapies
- know safety aspects of working in a S2 laboratory and working with infectious agents
- are able to understand, explain and evaluate fundamental concepts and research results in the field of virology

Skills to be acquired/competencies:
++ comprehensive understanding of the fundamentals of virology
++ knowledge of virological working methods
+ data analysis skills
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
++ data presentation and discussion (written and spoken)
+ teamwork
+ ethics and professional behavior

Module contents

| Lecture: Fundamentals of virology |
| Seminar: Discussion of selected aspects and methods of virology based on original/current literature |
| Exercises: cell culture, viral replication assays, luminescence assays, microscopy, data analysis and interpretation |

Literature empfehlungen

Literature will be provided during the lecture/seminar

Language of instruction: English

Duration (semesters): 1 Semester

Module frequency: summer term

Module capacity: 16

Modulelevel / module level

Modulart / typ of module

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination

<table>
<thead>
<tr>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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</thead>
<tbody>
<tr>
<td>at the end of the course</td>
<td>graded: written examination, ungraded: presentation (seminar), protocol (exercise)</td>
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Form of instruction

<table>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
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<td>Lecture</td>
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<td>SoSe</td>
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<td>Seminar und Übung</td>
<td>3</td>
<td>SoSe</td>
<td>42</td>
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Präsenzzeit Modul insgesamt: 56 h
### bio845 - Introduction to Development and Evolution

<table>
<thead>
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<th>Introduction to Development and Evolution</th>
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<tr>
<td>Modulkürzel</td>
<td>bio845</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
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<tr>
<td>Workload</td>
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**Verwendbarkeit des Moduls**
- Master's Programme Biology (Master) > Background Modules
- Master's Programme Molecular Biomedicine (Master) > Background Modules
- Master's Programme Neuroscience (Master) > Background Modules

**Zuständige Personen**
- Sienknecht, Ulrike (module responsibility)
- Sienknecht, Ulrike (Module counselling)
- Sienknecht, Ulrike (Prüfungsberechtigt)
- Claußen, Maike (Prüfungsberechtigt)

**Prerequisites**

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

**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
Literaturempfehlungen

Literatur:

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

**Links**

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**

**Module capacity**
20 (selection criteria: sequence of registration)

**Reference text**
associated with bio846 (neu120) (Lab Exercises in Development and Evolution)

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

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

**Vorkenntnisse / Previous knowledge**
organismic biology, developmental biology, evolutionary biology, neurobiology, genetics, molecular biology

**Examination**

**Final exam of module**
same winter term
oral exam of 30 minutes (or written exam)

**Form of instruction**

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<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<td>45</td>
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**Präsenzzeit Modul insgesamt**
90 h
gsw231 - Molecular Pharmacology and Toxicology

Module label: Molecular Pharmacology and Toxicology
Modulkürzel: gsw231
Credit points: 6.0 KP
Workload: 180 h

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

Zuständige Personen
- Rauch, Bernhard (module responsibility)
- Rauch, Bernhard (Prüfungsberechtigt)
- Meyer, Ulrike (Module counselling)

Prerequisites
Enrolment in the Master’s programme „Molecular Biomedicine“
Enrolment in the Bachelors’ programme „Chemie“

Skills to be acquired in this module
Upon completion of this module, students
- know about the subject of pharmacology in general, its areas of expertise such as pharmacokinetics and pharmacodynamics and their functions.
- understand on which pathophysiological mechanisms diseases are based and on which molecular targets pharmaceuticals act in order to alleviate diseases.
- know the basic actions and side effects of important drug groups.
- understand basic parameters of clinical studies and the importance of clinical studies for therapeutic approaches.

Skills to be acquired/ competencies:
++ deepened biological expertise
++ deepened clinical expertise
+ interdisciplinary thinking
+ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ data presentation and discussion (written and spoken)
+ ethics and professional behavior
+ basic knowledge of physiology and biochemistry is required

Module contents
- Fundamentals of general pharmacology, its specialist areas such as pharmacokinetics and pharmacodynamics
- Explanation of the pathophysiological mechanisms of diseases and the corresponding molecular drugs targets
- Mechanisms of action and side effects of the major drug groups
- Mechanisms of action and toxins
- Mechanisms of action of common toxins and antidotes
- Knowledge of basic parameters of clinical studies and understanding of the importance of clinical studies for therapeutic approaches

Literatureempfehlungen
Basic & Clinical Pharmacology (Basic and Clinical Pharmacology), McGraw-Hill Education (2020)
For German speaking students: Kurzlehrbuch Pharmakologie und Toxikologie, Herdegen,Thieme (2019)

Links
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: 40
Module level / module level
Module capacity: 40
Modulart / typ of module
Lehr-/Lernform / Teaching/Learning method
Vorkenntnisse / Previous knowledge
Examination: Prüfungszeiten
Type of examination: Klausur oder mündl. Prüfung

Final exam of module

Form of instruction: Lecture
SWS: 4
Frequency: SoSe oder WiSe
| Workload Präsenzzzeit | 56 h (4 SWS) |
gsw235 - Practical Molecular Pharmacology

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<td>Workload</td>
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<td>(5 SWS ca. 70 h (two weeks practical seminar/laboratory exercise))</td>
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Verwendbarkeit des Moduls
- Master's Programme Molecular Biomedicine (Master) > Background Modules

Zuständige Personen
- Rauch, Bernhard (module responsibility)
- Rauch, Bernhard (Prüfungsberechtigt)
- Meyer, Ulrike (Module counselling)

Prerequisites
- Enrollment in Master's programme
- Admission requirement is attendance of the gsw230 module (“Lecture Molecular Pharmacology”)
- Places are based on attended module “Lecture Molecular Pharmacology” and given grades.
- Knowledge of physiology and biochemistry is required.

Skills to be acquired in this module
- Upon completion of this module, students
  - have fundamental knowledge of good laboratory practice.
  - have an in-depth understanding of different working methods in the laboratory.
  - understand basic parameters of studies and the importance for basic research and therapeutic approaches.

  Skills to be acquired/competencies:
  ++ deepened biological expertise
  ++ deepened clinical expertise
  ++ deepened knowledge of biological working methods
  ++ data analysis skills
  ++ critical and analytical thinking
  + deepened knowledge of clinical diagnostics
  + interdisciplinary thinking
  + independent searching and knowledge of scientific literature
  + data presentation and discussion (written and spoken)
  + teamwork
  + ethics and professional behavior

Module contents
- Fundamentals of experimental pharmacology, common analytical laboratory techniques in this area
- Explanation of the pathophysiological mechanisms of diseases and the corresponding molecular drugs targets
- Specific knowledge on selected current research topic in the field of experimental pharmacology
- Knowledge of basic parameters of clinical studies and understanding of the importance of clinical studies for therapeutic approaches

Literaturempfehlungen
- Basic & Clinical Pharmacology (Basic and Clinical Pharmacology), McGraw-Hill Education (2020)
- For German speaking students: Kurzlehrbuch Pharmakologie und Toxikologie, Herdegen, Thieme (2019)

Links

Language of instruction
- English

Duration (semesters)
- 1 Semester

Module capacity
- 8

Module level / module level

ModuleArt / typ of module

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination
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28 / 63
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<td>SoSe oder WiSe</td>
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<td></td>
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gsw270 - Introduction to Human Anatomy

Module label: Introduction to Human Anatomy

Modulkürzel: gsw270

Credit points: 3.0 KP

Workload: 90 h

Verwendbarkeit des Moduls:
- Master's Programme Molecular Biomedicine (Master) > Background Modules

Zuständige Personen:
- Maier, Esther Christine (module responsibility)
- Maier, Esther Christine (Prüfungsberechtigt)

Prerequisites

Skills to be acquired in this module
- Competencies: Anatomical knowledge of body structure
- Functional anatomical knowledge of the body
- Understanding the anatomical basis for specific clinical symptoms
- Find and name anatomical structures during virtual dissections and annotations
- Group work

Module contents
- Description
- +++ Anatomical knowledge
- ++ Social skills
- + Interdisciplinary knowledge
- + Data present./disc.
- ++ Scientific English
- ++ Ethics

Students should be able to correctly identify the anatomical structures of the body and describe the major anatomical pathways connecting the different parts. They also should acquire an understanding of the functional anatomy. This knowledge is applied to analyse some specific examples of clinical symptoms, to deepen the students understanding of the functional relationships of the body parts. Lectures will be complete by virtual dissection exercises and anatomical seminars.

Literaturempfehlungen

Links

Language of instruction: English

Duration (semesters): 1 Semester

Module frequency

Module capacity: unlimited

Modullevel / module level

Modulart / typ of module

Lehr-/Lernform / Teaching/Learning method

Vorkenntnisse / Previous knowledge

Examination

Prüfungszeiten

Type of examination

Final exam of module

Portfolio oder mündl. Prüfung oder Präsentation

Oral exam or portfolio or presentation will be graded

Form of instruction

Comment

SWS

Frequency

Workload of compulsory attendance

Lecture

1

SoSe oder WiSe

0

Seminar

1

SoSe oder WiSe

0

Präsenzzeit Modul insgesamt

0 h
Clinical Modules

gsw060 - Epigenetics and Gene Regulation

Module label: Epigenetics and Gene Regulation
Modulkürzel: gsw060
Credit points: 6.0 KP
Workload: 180 h

Verwendbarkeit des Moduls: Master's Programme Molecular Biomedicine (Master) > Clinical Modules

Zuständige Personen:
- Plösch, Torsten (module responsibility)
- Heep, Axel (module responsibility)
- Plösch, Torsten (Prüfungsberechtigt)
- Heep, Axel (Prüfungsberechtigt)
- Hinz, Cornelia (Prüfungsberechtigt)

Prerequisites: Enrolment in Master's programme Molecular Biomedicine

Goals of the Module:
Upon successful completion of this module, students
- know about epigenetic regulation of gene transcription
- can determine different epigenetic features
- have a basic understanding of the role of epigenetics in human disease

Competencies:
++ deepened biological expertise
+ deepened clinical expertise
++ deepened knowledge of biological working methods
+ deepened knowledge of clinical diagnostics
+ data analysis skills
+ critical and analytical thinking
+ ability to perform independent biological research
+ data presentation and discussion (written and spoken)
+ teamwork

Module contents:

Lecture:
- introduction to epigenetics
- regulation of gene expression
- developmental epigenetics
- cancer epigenetics
- current methods
- ethics

Seminar:
- presentation of important historical and current primary literature
- presentation and discussion of lab methods used in the practical part

Exercise:
- Designing bisulfite PCR strategies for methylated DNA
- analyses of datasets
- DNA isolation from cells
- in vitro methylation of DNA
- methylation-specific restriction analysis (and PCR)
- methylation-specific bisulfite PCR
- histone characterization

Literaturempfehlungen

Links: https://uol.de/en/paediatrics/perinatal-neurobiology

Language of instruction: English

Duration (semesters): 1 Semester

Module frequency: summer term

Module capacity: 12

Reference text: The number of participants for this module is limited to 12. If there are more students registered than places available, lots will be drawn. Students which are enrolled in Master’s programme Molecular Biomedicine will be preferred.

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

Modulart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method: Lecture, Seminar, Exercises

Vorkenntnisse / Previous knowledge: basic knowledge in cell and developmental biology, solid knowledge in...
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<th>Prüfungszeiten</th>
<th>Prüfung</th>
<th>Type of examination</th>
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<td>presentation 50%, protocol 50%</td>
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<tr>
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</table>
### Module Information

**Module label**: Gene-based Therapies in Human diseases

**Modulkürzel**: gsw070

**Credit points**: 6.0 KP

**Workload**: 180 h

**Verwendbarkeit des Moduls**: Master's Programme Molecular Biomedicine (Master) > Clinical Modules

**Zuständige Personen**: Neidhardt, John (module responsibility), Neidhardt, John (Prüfungsberechtigt), Jüschke, Christoph (Prüfungsberechtigt)

**Prerequisites**: Enrolment in Master’s programme Molecular Biomedicine

**Skills to be acquired in this module**

**Competencies**:  
++ deepened biological expertise  
++ deepened clinical expertise  
++ deepened knowledge of biological working methods  
+ deepened knowledge of clinical diagnostics  
+ 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 (written and spoken)  
+ team work  
+ project and time management

Adressing students with emphasis on translational/therapeutical interest in molecular biology, molecular genetics, cell biology and neurobiology.

**Module contents**

The module focuses on translational research in human genetics, molecular biology, molecular genetics, translational medicine, cell- and neurobiology.

Subjects of the lecture: Therapeutic strategies and research applications, molecular bases of neurodegenerative diseases, structure and function of DNA/RNA/proteins/membranes.

Lecture: To improve knowledge in molecular genetics, molecular biology and cell biology in correlation with human diseases, gain knowledge in Antisense-Oligonucleotide-, U1- and CRISPR-based genetic therapies, viruses in gene therapy, cell sorting and diagnosis by FACS.

Exercises: Learning current methods of therapy development; molecular biology and human genetics; high throughput technologies; introduction to cell cultivation techniques.

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.

**Literaturempfehlungen**: Molecular Biology of the Cell (Alberts et al., 6th edition)

**Links**: https://uol.de/humangenetik/research-and-clinical-collaborations/

**Language of instruction**: English

**Duration (semesters)**: 1 Semester

**Module frequency**: summer semester

**Module capacity**: 15

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

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

**Lehr-/Lernform / Teaching/Learning method**: Lecture and Exercise

**Vorkenntnisse / Previous knowledge**: basic knowledge of cell biology, genetics

**Examination**

**Prüfungszeiten**: Type of examination

**Final exam of module**: written examination (90 min.)  
additionaly ungraded: signed lab protocols and regular active participation is required for the module to be passed

**Form of instruction**: Comment  
SWS  
**Frequency**  
**Workload of compulsory attendance**
<table>
<thead>
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<th>Comment</th>
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<td><strong>56 h</strong></td>
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</table>
### Module Contents

The module focuses on genome- and gene mutations, cyto- and molecular genetics, human syndromes and diseases caused by different chromosomal aberrations.

**Lecture:**
- essentials of classical cytogenetics and molecular genetics, classification of mutations, genetics syndromes/diseases, introduction to the genetic diagnostic laboratory techniques

**Exercises:**
- chromosomal stainings, microscopy, karyotyping, identification of chromosomal aberrations, identification of gene mutations

### Literature Empfehlungen

Principles of Clinical Cytogenetics by Steven L. Gersen, Martha B. Keagle

### Links

https://uol.de/genetik-gehirnfehlbildungen/forschungsschwerpunkte/

### Module Overview

**Module Label:** Genetic Diagnostics: from chromosomal aberrations to gene mutations

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<td>Workload</td>
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<tr>
<td>Module Capacity</td>
<td>10</td>
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</table>

**Goals of the Module:**
To expand the knowledge about classical cytogenetics and molecular genetics as well as modern cyto- and molecular genetics technics applied in clinical diagnostics and research.

**Competencies:**
- +++ deepened biological and clinical expertise (cytogenetics and molecular genetics)
- +++ deepened knowledge of biological working methods and clinical diagnostics (classical cyto- and molecular genetics laboratory methods)
- +++ data analysis skills
- +++ interdisciplinary thinking
- +++ critical and analytical thinking
- +++ ability to perform independent biological research
- +++ data presentation and discussion (written and spoken)
- +++ team work
- +++ project and time management

**Module Contents**

- Essentials of classical cytogenetics and molecular genetics, classification of mutations, genetics syndromes/diseases, introduction to the genetic diagnostic laboratory techniques
- Chromosomal stainings, microscopy, karyotyping, identification of chromosomal aberrations, identification of gene mutations

**Language of instruction:** English

**Duration (semesters):** 1 Semester

**Module Frequency:** Second half of the winter semester

**Module Level / Module Level:** MM (Mastermodul / Master module)

**Type of Module:** Wahlpflicht / Elective

**Teaching/Learning Method:** Lecture, Seminar and Exercise

**Previous Knowledge:** Basic knowledge of genetics and cell biology

**Examination:**
- Written examination (90 min., 70%), presentation (30%)
- Additionally ungraded: signed lab protocols

**Form of Instruction**

<table>
<thead>
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<th>SWS</th>
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<th>Workload of compulsory attendance</th>
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<tr>
<td>Exercises</td>
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<td>WiSe</td>
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gswo90 - Current Topics in Clinical Research

<table>
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<td>6.0 KP</td>
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<tr>
<td>Workload</td>
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Verwendbarkeit des Moduls
- Master's Programme Molecular Biomedicine (Master) > Clinical Modules

Zuständige Personen
- Dömer, Patrick (module responsibility)
- Dömer, Patrick (Prüfungsberechtigt)
- Heep, Axel (Prüfungsberechtigt)
- Plösch, Torsten (Prüfungsberechtigt)
- Loser, Karin (Prüfungsberechtigt)
- Hinz, Cornelia (Prüfungsberechtigt)
- Dübbel, Lena (Prüfungsberechtigt)
- Hamprecht, Axel (Prüfungsberechtigt)
- Noster, Janina (Prüfungsberechtigt)
- Rauch, Bernhard (Prüfungsberechtigt)
- Meyer, Helge (Prüfungsberechtigt)
- Helgers, Simeon (Prüfungsberechtigt)

Prerequisites
Enrolment in Master’s programme Molecular Biomedicine

Goals of the Module:
Upon successful completion of this module, students
- are familiar with the basic epigenetic mechanisms
- know the principles of different sequencing techniques, both for genetic and epigenetic research
- are familiar with the "first 1000 days of life concept" and how the early environment influences long term health
- know how the human body is colonized
- know about the basic mechanisms involved in CNV development during fetal and early postnatal life
- know about the methods used to study molecular intercellular signaling
- know about the non-invasive methods used to study functional brain development
- know about the insults leading to cerebral ischemia
- know about the mechanism of the neurovascular response
- know about the cellular and electrophysiological effects of acute and chronic cerebral ischemia
- know about the cell types, cellular interactions and molecular changes during peripheral nerve; degeneration and regeneration following nerve trauma
- are able to explain some oncogenic mechanisms of viruses
- can explain preeclampsia and its immunological regulation
- are familiar with antibiotic classes, mode of actions of antibiotics, principles of antibiotic resistance, dissemination of current plasmids causing multi-resistance
- know about differences between susceptibility, tolerance, resistance and persistence to antibiotics, the methods to determine minimal inhibitory concentrations, the causes of persistent infections, the characteristics of persister cells and mechanisms of persistor cell formation, and current medical treatment strategies
- are able to explain the concept of cancer immunosurveillance and immunoediting
- can explain current strategies in immunotherapy of cancer including checkpoint inhibition, CAR T cell therapy and cancer vaccination
- are able to explain the mechanisms underlying therapy resistance in malignant diseases, particularly cancers of the gastrointestinal tract and the hepatico-pancreatico-biliary system
- can explain current strategies in cancer diagnostic, particularly liquid biopsy

Competencies:
++ deepened clinical expertise
++ deepened knowledge of biological working methods and clinical diagnostics
++ interdisciplinary thinking
+ data analysis skills
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ ethics and professional behavior

Module contents
The module focuses on molecular aspects as part of current clinical research in different fields.

Lectures:
(Part 1)
- Genetic and epigenetic sequencing technology
- Epigenetic programming by early life events
- The human microbiome and colonization of the human body
- Molecular insights into functional brain development
- Basic mechanisms involved in CNS development during fetal and early postnatal life
- Introduction to methods used to study molecular signaling
- Introduction to non-invasive methods used to study functional brain development

(Part 2)
- Contribution of the immune system to the progression of infection, autoimmunity, cancer or (neuro-) inflammation
- Modulation of the immune system as a potential therapeutic option
- Interaction of the microbiome with the immune system and impact of environmental factors on the development of immune-mediated diseases

(Part 3)
- Oncogenic potential of viruses (e.g. Cervix carcinoma caused by HPV viruses)
- Molecular insights into carcinogenesis
- Preeclampsia and it’s immunological regulation

(Part 4)
- Concept of cancer immunosurveillance and immunoediting
- Current strategies for cancer immunotherapy
- Mechanisms of cancer therapy resistance
- Current strategies for cancer diagnosis and liquid biopsy

(Part 5)
- Insights into antibiotic resistance (mode of antibiotics, principles of antibiotic resistance)
- Emergence of multi-resistance and dissemination of plasmids causing multi-resistance
- Differences between susceptibility, tolerance, resistance and persistence of pathogens to antibiotics
- Current hypotheses of inducers for persister cell formation and medical treatment

(Part 6)
- Neurovascular regulation in response to cerebral ischemia
- Molecular and cellular mechanisms of peripheral nerve regeneration

**Literaturempfehlungen**
Current literature on topics will be provided via Stud.IP

**Links**

**Language of instruction**
English

**Duration (semesters)**
1 Semester

**Module frequency**
winter semester

**Module capacity**
25

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

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

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

**Vorkenntnisse / Previous knowledge**

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<th>Prüfungszeiten</th>
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<td>written examination (90 min.)</td>
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**Form of instruction**
Lecture

**SWS**
4

**Frequency**
WiSe

**Workload Präsenzzeit**
56 h
gsw100 - Immunology and Inflammation

<table>
<thead>
<tr>
<th>Module label</th>
<th>Immunology and Inflammation</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw100</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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<tr>
<td>Verwendbarkeit des Moduls</td>
<td>- Master's Programme Molecular Biomedicine (Master) &gt; Clinical Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>- Gibbs, Bernhard (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>- Gibbs, Bernhard (Module counselling)</td>
</tr>
<tr>
<td></td>
<td>- Fakultät 6 Dekanat (module responsibility)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Enrolment in Master’s programme Molecular Biomedicine</td>
</tr>
</tbody>
</table>

Skills to be acquired in this module

- Competencies:
  ++ comprehensive understanding of the fundamentals of immunology and inflammation
  ++ deepened knowledge of clinical aspects of diseases
  ++ systematic understanding in the therapy diseases
  + interdisciplinary thinking
  + critical and analytical thinking
  ++ independent searching and knowledge of scientific literature
  ++ data presentation and discussion (written and spoken)
  + teamwork
  + time management

Module contents

The module focuses on dermatology, immunology and inflammation.

Lectures:
Fundamentals of immunology and inflammation

Seminars:
Worked examples of major inflammatory diseases (e.g. allergies, infections, autoimmune diseases) and advanced therapeutic concepts.

Exercises:
Students will be expected to demonstrate the ability to prepare presentations in small working groups where they critically evaluate current research regarding specific examples of inflammatory diseases and their therapy (problem-orientated learning)

Literaturempfehlungen

Textbooks: Janeway’s Immunobiology; Authors: Kenneth Murphy, Casey Weaver; 2016 (9th Edition; Garland Science), Cellular and Molecular Immunology; Authors: Abul Abbas, Andrew H. Lichtman, Shiv Pillai; 2017 (9th Edition; Elsevier) Example review article: Siebenhaar F, Redegeld FA, Bischoff SC, Gibbs BF, Maurer M. Mast Cells as Drivers of Disease and Therapeutic Targets. Trends Immunol. 2018 Feb;39(2):151-162. doi: 10.1016/j.it.2017.10.005

Links
https://uol.de/dermatologie/forschung/

Language of instruction
English

Duration (semesters)
1 Semester

Module frequency
First half of the winter semester

Module capacity
25

Module level / module level
MM (Mastermodul / Master module)

Modulart / typ of module
Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method
Lecture, Seminar, Exercise

Vorkenntnisse / Previous knowledge
basis knowledge in immunology

Examination Prüfungszeiten Type of examination

Final exam of module
graded: written examination (60 min, 60%), coursework (short review in English in the style "News and Views" article, 40%) ungraded: formative feedback given for presentations

Form of instruction Comment SWS Frequency Workload of compulsory attendance

Lecture 1.5 WiSe 21
Seminar 1 WiSe 14
<table>
<thead>
<tr>
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<th>Comment</th>
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<td></td>
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gsw110 - Clinical Aspects of Degenerative Diseases

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<tr>
<td>Zuständige Personen</td>
<td>Zieschang, Tania (module responsibility)</td>
</tr>
<tr>
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<td>Dewald, Oliver (module responsibility)</td>
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<td>Zieschang, Tania (Prüfungsberechtigt)</td>
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<td>Koschate, Jessica (Prüfungsberechtigt)</td>
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<td>Meillert, Friedrich (Prüfungsberechtigt)</td>
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<td>Ort, Katharina (Prüfungsberechtigt)</td>
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<td>Hoppe, Florian (Prüfungsberechtigt)</td>
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<tr>
<td>Skills to be acquired in this module</td>
<td>Competencies:</td>
</tr>
<tr>
<td></td>
<td>++ comprehensive understanding of clinical manifestation, epidemiology, risk factors, treatment strategies of degenerative diseases</td>
</tr>
<tr>
<td></td>
<td>++ understanding of geriatric phenomena</td>
</tr>
<tr>
<td></td>
<td>++ understanding and application of the comprehensive geriatric assessment (CGA)</td>
</tr>
<tr>
<td></td>
<td>++ interdisciplinary thinking</td>
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<td>++ ethics and professional behaviour</td>
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<td>++ critical and analytical thinking</td>
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<td></td>
<td>+ independent searching and knowledge of scientific literature</td>
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<tr>
<td></td>
<td>++ data presentation and discussion (written and spoken)</td>
</tr>
<tr>
<td></td>
<td>++ teamwork</td>
</tr>
<tr>
<td>Module contents</td>
<td>The module focuses on geriatric medicine.</td>
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<tr>
<td></td>
<td><strong>Lecture:</strong> fundamentals of degenerative diseases (Alzheimer's disease, Parkinson's disease, Rheumatoid Arthritis, Osteoarthritis, heart valve disease, aortic dilatation) and geriatric phenomena as frailty, multimorbidity and polypharmacy and their impact on diagnostic and treatment options, basics of geriatric medicine, evidence of the impact of the CGA on patient outcomes, dimensions of the CGA, surgical and interventional heart procedures in geriatric patients</td>
</tr>
<tr>
<td></td>
<td><strong>Seminar:</strong> instant ageing, the geriatric team, cognitive assessment with actors, work in heart team</td>
</tr>
<tr>
<td></td>
<td><strong>Excursion:</strong> small groups (2 students) can accompany clinical rounds on the geriatric ward (either acute geriatric care or geriatric rehabilitation), Conduction of parts of the CGA with patients</td>
</tr>
<tr>
<td>Literatureempfehlungen</td>
<td>Textbooks on geriatric medicine and geriatric psychiatry, e.g. Zeyfang et al. Basiswissen Medizin des Alterns und des alten Menschen. Springer. Textbooks on cardiac surgery and cardiology, e.g. Ziemer, Haverich: Herzchirurgie.</td>
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<tr>
<td></td>
<td>Scientific papers related to current research topics will be available in Stud.IP</td>
</tr>
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<td>Links</td>
<td><a href="https://www.aortenklappenregister.de/publikationen-des-registers.html">https://www.aortenklappenregister.de/publikationen-des-registers.html</a></td>
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<td>Wahlpflicht / Elective</td>
</tr>
<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
<td>Lecture, Seminar, Excursion</td>
</tr>
<tr>
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<td>physiology and cardiovascular system</td>
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<td>Prüfungszeiten</td>
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<td>Final exam of module</td>
<td>written examination (60 min, 50%), case presentation (50%)</td>
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| Form of instruction Comment SWS Frequency Workload of compulsory attendance
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<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Seminar</td>
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<td>21</td>
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<td>WiSe</td>
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**Präsenzzeit Modul insgesamt** 63 h
**Tumor Biology**

**Module label**: Tumor Biology  
**Modulkürzel**: gsw120  
**Credit points**: 6.0 KP  
**Workload**: 180 h  

**Verwendbarkeit des Moduls**  
- Master's Programme Molecular Biomedicine (Master) > Clinical Modules

**Zuständige Personen**  
- Griesinger, Frank (module responsibility)  
- Griesinger, Frank (Prüfungsberechtigt)  
- Roeper, Julia (Prüfungsberechtigt)  
- Dübbel, Lena (Prüfungsberechtigt)  
- Loser, Karin (Prüfungsberechtigt)  
- Myklicki, Nadine (Prüfungsberechtigt)  
- Dübbel, Lena (Module counselling)  
- Roeper, Julia (Module counselling)

**Prerequisites**  
Enrolment in Master’s programme Molecular Biomedicine

**Skills to be acquired in this module**  
**Goals of the Module:**
Upon successful completion of this module, students
- can define and identify oncogenes and tumor suppressor genes
- know about the hallmarks of cancer and can explain them based on example pathways and traits
- know about the complexity of the tumor tissue and the different cells that are involved
- know about the principles of metastasis.

**Competencies:**
++ deepened biological & clinical expertise  
++ interdisciplinary thinking  
++ deepened knowledge of biological working methods & clinical diagnostics  
++ data analysis skills  
+ usage of databases and computational tools  
++ critical & analytical thinking  
+ independent searching & knowledge of scientific literature  
++ data presentation & discussion (written and spoken)  
+ teamwork  
++ ethics & professional behavior

**Module contents**

**Part 1 - Lecture:**
We will give a brief overview of several aspects of tumor biology: Types of mutation, hallmarks of cancer, tumor as a tissue, metastasis, oncogenes and tumor suppressor genes, signal transduction and many example pathways that are important for cancer progression. In addition, you will learn about tumor-infiltrating immune cells and new therapy options like tumor-immune therapy.

**Part 2 - Seminar:**
Students will be expected to demonstrate the ability to prepare presentations in small working groups where they critically evaluate current research regarding specific examples of tumor diseases and their therapy (problem-orientated learning)

**Optional:**
Lectures from the study programme Human Medicine (winter semester only; will be held in German): Lecture topics from the human Medicine programme focusses on large tumor entities, therapy strategies, and basics of carcinogenesis and therapeutic implementation. Please note, that these lectures are not part of the curriculum and are therefore not relevant for the examinations.

**Literatureempfehlungen**  
Current literature will be uploaded on Stud.IP. Previous literature research is not necessary. If you are looking for more information/background: Weinberg: "The Biology of Cancer"; Garland Science

**Links**

**Language of instruction**: English  
**Duration (semesters)**: 1 Semester  
**Module frequency**: winter and summer semester (seminars during the semester break)  
**Module capacity**: 25

**Reference text**
The number of participants for this module is limited to 25. If there are more students registered than places available, lots will be drawn. Students which
are enrolled in Master’s programme Molecular Biomedicine will be preferred.

<table>
<thead>
<tr>
<th>Module level / module level</th>
<th>MM (Mastermodul / Master module)</th>
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<tbody>
<tr>
<td>Modulart / type of module</td>
<td>Wahlpflicht / Elective</td>
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<table>
<thead>
<tr>
<th>Lehr-/Lernform / Teaching/Learning method</th>
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</thead>
<tbody>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
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<tr>
<td>Basic knowledge of genetics, cell biology and biochemistry</td>
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</table>

<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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<tbody>
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<td>Final exam of module</td>
<td>written examination (60 min., 75%), presentation (25%)</td>
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<table>
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<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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<tr>
<td>Lecture</td>
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<td>2</td>
<td>SoSe und WiSe</td>
<td>28</td>
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<tr>
<td>Seminar</td>
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<td>2</td>
<td>SoSe und WiSe</td>
<td>28</td>
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</table>

<table>
<thead>
<tr>
<th>Präsenzzeit Modul insgesamt</th>
<th>56 h</th>
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</table>
gsw130 - Regenerative Medicine in Ophthalmology

Module label: Regenerative Medicine in Ophthalmology

Modulkürzel: gsw130

Credit points: 6.0 KP

Workload: 180 h

Verwendbarkeit des Moduls: Master's Programme Molecular Biomedicine (Master) > Clinical Modules

Zuständige Personen: Mertsch, Sonja (module responsibility), Mertsch, Sonja (Prüfungsberechtigt), Schrader, Stefan (Prüfungsberechtigt)

Prerequisites: Enrolment in Master’s programme Molecular Biomedicine

Skills to be acquired in this module: Competencies: ++ comprehensive understanding of the fundamentals of regenerative research ++ deepened knowledge of clinical aspects of eye diseases ++ deepened knowledge of biological lab methods and clinical diagnostics (classical tissue engineering, cell culture and molecular laboratory methods) ++ systematic understanding in translational research + interdisciplinary thinking + critical and analytical thinking ++ data analysis and interpretation skills ++ data presentation and discussion (written and spoken) ++ teamwork

Module contents: The module focuses on regenerative medicine in ophthalmology.

Lectures: Fundamentals of ophthalmologic diseases and insights of current ophthalmologic research projects including tissue engineering methods

Exercises: Practical laboratory work: generation of tissue engineered artificial cornea, preparation of porcine cornea and retina, cultivation of primary corneal stem cells, sample preparation for protein and mRNA, Western Blotting, PCR, Paraffin sectioning, HE-staining

Literaturempfehlungen: Textbooks of ophthalmology, anatomy, current literature concerning tissue engineering methods in ophthalmology. Primary and secondary literature of the field will be provided and introduced at the first meeting.

Links: https://uol.de/augenheilkunde

Language of instruction: English

Duration (semesters): 1 Semester

Module frequency: winter semester

Module capacity: 5

Reference text: The number of participants is limited to 5. Students which are enrolled in Master’s programme Molecular Biomedicine will be preferred.

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

Modultyp / type of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method: Lecture and Exercise

Vorkenntnisse / Previous knowledge: basic knowledge of cell culture methods, protein and mRNA isolation methods

Examination: Prüfungszeiten

Final exam of module: protocol (30%) and presentation (70%)

Form of instruction: Comment SWS Frequency Workload of compulsory attendance

Lecture: 1 WiSe 14

Exercises: 3 WiSe 42

Präsenzzeit Modul insgesamt: 56 h
# Research Modules

**gsw150 - Research Project Molecular Biomedicine**

<table>
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<tbody>
<tr>
<td>Modulkürzel</td>
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<td>Credit points</td>
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<td>Workload</td>
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<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Research Modules</td>
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<tr>
<td>Zuständige Personen</td>
<td>Koch, Karl-Wilhelm (module responsibility)</td>
</tr>
<tr>
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<td>Koch, Karl-Wilhelm (Prüfungsberechtigt)</td>
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<tr>
<td>Further responsible persons</td>
<td>all teachers of the curriculum (module counselling, authorized examiners)</td>
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<tr>
<td>Prerequisites</td>
<td>as defined in the admission and examination regulations</td>
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</tbody>
</table>

**Skills to be acquired in this module**

| Competencies: | ++ deepened biological and / or clinical expertise |
|              | ++ deepened knowledge of biological working methods and / or clinical diagnostics |
|              | ++ 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 (written and spoken) |
|              | + team work |
|              | + ethics and professional behaviour |
|              | + project and time management |

**Module contents**

**Emphasis on research**

Theory and practice of topics related to issues in molecular biomedicine; independent treatment of an individual project; acquiring an advanced theoretical knowledge in selected fields of the molecular biology of the cell (points of emphasis: genetics, biochemistry, cell biology; topics depending on research groups)


**Literatureempfehlungen**

Specific literature of the topics indicated above; original papers related to the current research question; will be different for every student and every year.

**Links**

**Language of instruction**

English

**Duration (semesters)**

1 Semester

**Module frequency**

every semester, time is flexible and subject to individual arrangement

**Module capacity**

unlimited

**Modullevel / module level**

MM (Mastermodul / Master module)

**Modulart / type of module**

Wahlpflicht / Elective

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

Lecture and Project

**Vorkenntnisse / Previous knowledge**

basic knowledge of cell biology, genetics, biochemistry or clinical biomedicine

<table>
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<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>graded: project report ungraded: participation in seminar and 30 min. presentation</td>
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<tr>
<td>Form of instruction</td>
<td>Comment</td>
<td>SWS</td>
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<tr>
<td>Seminar</td>
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<tr>
<td>Project (Individuelles</td>
<td>Forschungsprojekt)</td>
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<td>Präsenzzeit Modul insgesamt</td>
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**gsw160 - External Research Project Molecular Biomedicine**

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<td>Zuständige Personen</td>
<td>• Koch, Karl-Wilhelm (module responsibility)</td>
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<tr>
<td></td>
<td>• Koch, Karl-Wilhelm (Prüfungsberechtigt)</td>
</tr>
<tr>
<td>Further responsible persons</td>
<td>all teachers of the curriculum (module counselling, authorized examiners)</td>
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<td>as defined in the admission and examination regulations</td>
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<td>++ deepened biological and / or clinical expertise</td>
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<td>++ deepened knowledge of biological working methods and / or clinical diagnostics</td>
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<td>++ data analysis skills</td>
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<td>++ ability to perform independent biological research</td>
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<td>++ data presentation and discussion (written and spoken)</td>
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<td>+ team work</td>
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<td>+ ethics and professional behaviour</td>
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<td>+ project and time management</td>
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<td>Module contents</td>
<td>Emphasis on research</td>
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<td>Theory and practice of topics related to issues in molecular biomedicine; independent treatment of an individual project; acquiring an advanced theoretical knowledge in selected fields of the molecular biology of the cell (points of emphasis: genetics, biochemistry, cell biology; topics depending on research groups).</td>
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<tr>
<td>Literatureempfehlungen</td>
<td>Specific literature of the topics indicated above; original papers related to the current research question; will be different for every student and every year.</td>
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</table>

**Language of instruction** English

**Duration (semesters)** 1 Semester

**Module frequency** every semester, time is flexible and subject to individual arrangement

**Module capacity** unlimited

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

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

**Lehr-/Lernform / Teaching/Learning method** Seminar and Project

**Vorkenntnisse / Previous knowledge** basic knowledge of cell biology, genetics, biochemistry or clinical biomedicine

**Examination**

<table>
<thead>
<tr>
<th>Type of examination</th>
<th>Prüfungszeiten</th>
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<tbody>
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<td>participation in seminar and 30 min. presentation</td>
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**Final exam of module**

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48 / 63
Skills Modules

gsw170 - Research Techniques Molecular Biomedicine

Module label: Research Techniques Molecular Biomedicine
Modulkürzel: gsw170
Credit points: 6.0 KP
Workload: 180 h

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

Zuständige Personen:
- Hartmann, Anna-Maria (module responsibility)
- Hartmann, Anna-Maria (Prüfungsberechtigt)

Prerequisites:
Enrolment in Master’s programme Molecular Biomedicine

Skills to be acquired in this module:
- Competencies:
  ++ deepened knowledge of biological working methods
  + deepened knowledge of clinical diagnostics
  ++ data analysis skills
  + interdisciplinary thinking
  ++ critical and analytical thinking
  ++ ability to perform independent biological research
  ++ data presentation and discussion (written and spoken)
- Basic knowledge of techniques used in molecular biomedicine

Module contents:
The module focuses on competence in research methods.

Seminar:
Hybridization and detection of nucleic acid, polymerase chain reaction, nucleic acid sequencing, analyses of epigenetic modifications, protein-nucleic acid Interaction, Immunological techniques, light microscopy techniques, mass spectrometry analyses, protein-protein interactions, fluorescence in situ hybridization

Exercise:
molecular biological techniques (PCR, agarose gel, plasmid preparation, restriction), immunological methods (cell culturing, cytochemistry), biochemistry techniques (SDS gel, western blotting, protein purification, photometry)

Literaturempfehlungen:

Links

Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: Second half of the winter semester; annually
Module capacity: 25
Modulart / typ of module: MM (Mastermodul / Master module)

Lehr-/Lernform / Teaching/Learning method: Seminar and Exercise

Vorkenntnisse / Previous knowledge

Examination
Prüfungszeiten
Type of examination
Final exam of module
graded: presentation (20 min.)
ungraded: signed protocols

Form of instruction
Comment
SWS
Frequency
Workload of compulsory attendance

Lecture
2
WiSe
28

Practical training
2
WiSe
28

Präsenzzeit Modul insgesamt
56 h

49 / 63
gsw180 - Ethics in Medicine

Module label: Ethics in Medicine
Modulkürzel: gsw180
Credit points: 3.0 KP
Workload: 90 h

Verwendbarkeit des Moduls: Master’s Programme Molecular Biomedicine (Master) > Skills Modules
Zuständige Personen: Schweda, Mark (module responsibility), Schweda, Mark (Prüfungsberechtigt), Weßel, Merle (Prüfungsberechtigt)

Prerequisites: Enrolment in Master’s programme Molecular Biomedicine

Skills to be acquired in this module
Competencies:
++ deepened medical / ethical expertise with a focus on research ethics
++ interdisciplinary thinking
++ critical and analytical thinking
+ independent searching and knowledge of scientific literature
+ ability to perform independent biological research
++ data presentation and discussion (written and spoken)
+ team work
++ ethics and professional behaviour
+ project and time management

Module contents
Concept of ethics and central theoretical approaches to ethics
Research ethical standards and their evolution
Good scientific practice (scientific misconduct, criteria of authorship, documentation of research, IRB approval)
Central areas of ethically sensitive research (stem cell and embryonic research, genomic research, clinical studies, social research)
Ethical problems in research (research with incompetent and vulnerable populations)

Literaturempfehlungen

Links
https://uol.de/medizinethik/

Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: winter semester
Module capacity: 25

Modullevel / module level: MM (Mastermodul / Master module)
Modulart / typ of module: Wahlpflicht / Elective

Lehr-/Lernform / Teaching/Learning method: Lecture

Vorkenntnisse / Previous knowledge

Examination Prüfungszeiten Type of examination
Final exam of module essay
Form of instruction Vorlesung und Seminar

SWS 2
Frequency W/S/W
Workload Präsenzzeit 28 h
**gsw190 - Journal Club**

<table>
<thead>
<tr>
<th><strong>Module label</strong></th>
<th>Journal Club</th>
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</thead>
<tbody>
<tr>
<td><strong>Modulkürzel</strong></td>
<td>gsw190</td>
</tr>
<tr>
<td><strong>Credit points</strong></td>
<td>3.0 KP</td>
</tr>
<tr>
<td><strong>Workload</strong></td>
<td>90 h</td>
</tr>
<tr>
<td><strong>Verwendbarkeit des Moduls</strong></td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td><strong>Zuständige Personen</strong></td>
<td>Mertsch, Sonja (module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Mertsch, Sonja (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Maier, Esther Christine (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Schrader, Stefan (Prüfungsberechtigt)</td>
</tr>
<tr>
<td><strong>Further responsible persons</strong></td>
<td>all teachers of the curriculum</td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td>Enrolment in Master’s programme Molecular Biomedicine. Neuroscience and Biology students can participate on request.</td>
</tr>
<tr>
<td><strong>Skills to be acquired in this module</strong></td>
<td>Competencies:</td>
</tr>
<tr>
<td></td>
<td>++ reading and understanding of original scientific literature</td>
</tr>
<tr>
<td></td>
<td>++ deepened biological expertise</td>
</tr>
<tr>
<td></td>
<td>++ deepened knowledge of biological working methods</td>
</tr>
<tr>
<td></td>
<td>++ data analysis skills</td>
</tr>
<tr>
<td></td>
<td>+ interdisciplinary thinking</td>
</tr>
<tr>
<td></td>
<td>++ critical and analytical thinking</td>
</tr>
<tr>
<td></td>
<td>++ independent searching and knowledge of scientific literature</td>
</tr>
<tr>
<td></td>
<td>+ ability to perform independent biological research</td>
</tr>
<tr>
<td></td>
<td>++ data presentation and discussion (written and spoken)</td>
</tr>
<tr>
<td><strong>Module contents</strong></td>
<td>The module focuses on current topics in molecular cell biology and biomedicine.</td>
</tr>
<tr>
<td></td>
<td>Seminar topics: original literature of molecular life science related to health and disease</td>
</tr>
<tr>
<td><strong>Literaturempfehlungen</strong></td>
<td>publications related to the current research question</td>
</tr>
<tr>
<td><strong>Links</strong></td>
<td></td>
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<tr>
<td><strong>Language of instruction</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Duration (semesters)</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Module frequency</strong></td>
<td>winter and summer semester</td>
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<tr>
<td><strong>Module capacity</strong></td>
<td>20</td>
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<td><strong>Modullevel / module level</strong></td>
<td>MM (Mastermodul / Master module)</td>
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<tr>
<td><strong>Modulart / typ of module</strong></td>
<td>Wahlpflicht / Elective</td>
</tr>
<tr>
<td><strong>Lehr-/Lernform / Teaching/Learning method</strong></td>
<td>Seminar</td>
</tr>
<tr>
<td><strong>Vorkenntnisse / Previous knowledge</strong></td>
<td>basic knowledge of cell biology, genetics, biochemistry</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Prüfungszeiten</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Type of examination</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Final exam of module</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 presentations</td>
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<td><strong>Form of instruction</strong></td>
<td>Seminar</td>
</tr>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>SoSe und WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzzeit</strong></td>
<td>28 h</td>
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</table>
### gsw200 - Microscopic Imaging in Biomedical Sciences

<table>
<thead>
<tr>
<th>Module label</th>
<th>Microscopic Imaging in Biomedical Sciences</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw200</td>
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<tr>
<td>Credit points</td>
<td>3.0 KP</td>
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<tr>
<td>Workload</td>
<td>90 h</td>
</tr>
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</table>

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

**Zuständige Personen**
- Dedek, Karin (module responsibility)
- Groß, Petra (Prüfungsberechtigt)
- Dedek, Karin (Prüfungsberechtigt)
- Solovyeva, Vita (Prüfungsberechtigt)

**Prerequisites**
- Enrolment in Master’s programmes Molecular Biomedicine and Neuroscience.

**Skills to be acquired in this module**
- Competencies:
  - deepened biological expertise
  - deepened knowledge of biological working methods
  - data analysis skills
  - interdisciplinary thinking
  - critical and analytical thinking
  - data presentation and discussion (written and spoken)
  - team work

**Module contents**
- The module focuses on microscopy, imaging and methods of microscopy.

  **Lecture:**
  Basics in optics, microscopy methods, image processing, biomedical applications

  **Seminar:**
  Examples for selected microscopy methods and their application.
  Different microscopical methods and their applications are discussed and compared. Students will understand the basics and limitations of microscopy methods and learn to evaluate them. Selected methods are demonstrated.

**Literaturempfehlungen**
- Literature will be provided during the lecture/seminar

**Links**
- English

**Duration (semesters)**
- 1 Semester

**Module capacity**
- afternoon event during winter semester

**Modulelevel / module level**
- MM (Mastermodul / Master module)

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

**Lehr-/Lernform / Teaching/Learning method**
- Lecture and Seminar

**Vorkenntnisse / Previous knowledge**
- basic physics, basic cell biology

**Examination**
- Prüfungszeiten
  - Type of examination
    - graded: written examination (60 min.), ungraded: presentation
    - Note: to qualify for the exam, regular participation during the semester is mandatory, no more than 2 days of absence

**Form of instruction**

<table>
<thead>
<tr>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>1</td>
<td>WiSe</td>
<td>14</td>
</tr>
<tr>
<td>Seminar</td>
<td>1</td>
<td>WiSe</td>
<td>14</td>
</tr>
</tbody>
</table>

**Präsenzzeit Modul insgesamt**
- 28 h
neu751 - Laboratory Animal Science

Module label
Laboratory Animal Science

Modulkürzel
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

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

Zuständige Personen
- Köppl, Christine (module responsibility)
- Köppl, Christine (Prüfungsberechtigt)
- Langemann, Ulrike (Prüfungsberechtigt)
- Nolte, Arne (Prüfungsberechtigt)
- Heyers, Dominik (Prüfungsberechtigt)
- Ebberts, Lena (Prüfungsberechtigt)
- Dedek, Karin (Prüfungsberechtigt)
- Schmaljohann, Heiko (Prüfungsberechtigt)
- Winklhofer, Michael (Prüfungsberechtigt)

Prerequisites
none

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

Upon successful completion of this course, students

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

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

Module contents
Background knowledge is taught using the third-party online platform "LAS Interactive" which concludes with a written exam that has to be passed before the practical part. Topics covered are:

- Legislation, ethics and the 3Rs
- Scientific integrity
- Data collection
- Basic biology of rodents, birds and fish
- Husbandry, and nutrition of rodents, birds and fish
- Animal Welfare
- Health monitoring
- Pain and distress
- Euthanasia
Practical procedures will first be demonstrated, important aspects will then be practiced under supervision by every participant, on an animal model of their choice (rodents, birds or fish):

- Handling and external examination
- Administration of substances, blood sampling
- Euthanasia and dissection
- Transcardial perfusion
- Anaesthesia and surgery

<table>
<thead>
<tr>
<th>Literatureempfehlungen</th>
<th>&quot;LAS interactive&quot; internet-based learning platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Links</td>
<td></td>
</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Module frequency</td>
<td>semester break, every semester</td>
</tr>
<tr>
<td>Module capacity</td>
<td>20 (Registration procedure / selection criteria: StudIP, sequence of registration)</td>
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</table>

<table>
<thead>
<tr>
<th>Modulelevel / module level</th>
<th>Modulart / typ of module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehr-/Lernform / Teaching/Learning method</td>
<td></td>
</tr>
<tr>
<td>Vorkenntnisse / Previous knowledge</td>
<td></td>
</tr>
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</table>

### Final exam of module
- Immediately before the practical part
- Written exam of 90 minutes

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td></td>
<td>1</td>
<td>SoSe und WiSe</td>
<td>14</td>
</tr>
<tr>
<td>Exercises</td>
<td></td>
<td>1</td>
<td>SoSe und WiSe</td>
<td>14</td>
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</table>

<table>
<thead>
<tr>
<th>Präsenzzeit Modul insgesamt</th>
<th>28 h</th>
</tr>
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</table>
# neu760 - Scientific English

<table>
<thead>
<tr>
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<th>Scientific English</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>neu760</td>
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<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
</tr>
<tr>
<td></td>
<td>0.5 SWS Lecture (VO)</td>
</tr>
<tr>
<td></td>
<td>Total workload 23h: 8h contact / 15h research for term paper</td>
</tr>
<tr>
<td></td>
<td>3.5 SWS Supervised exercise (UE)</td>
</tr>
<tr>
<td></td>
<td>Total workload 158h: 46h contact / 46h preparation of texts and presentations / 66h term paper</td>
</tr>
</tbody>
</table>

| Verwendbarkeit des Moduls | Master's Programme Biology (Master) > Skills Modules |
|                         | Master's Programme Molecular Biomedicine (Master) > Skills Modules |
|                         | Master's Programme Neuroscience (Master) > Skills Modules |

| Zuständige Personen     | Köppl, Christine (module responsibility) |
|                        | Köppl, Christine (Prüfungsberechtigt) |

| Prerequisites           | non-native speakers |

| Skills to be acquired in this module | + Neurosci. knowlg. |
|                                     | ++ Social skills |
|                                     | ++ Data present./disc. |
|                                     | ++ Scientific English |

Upon completion of this course, students

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

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

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

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

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
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<tbody>
<tr>
<td>Duration (semesters)</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Module frequency</td>
<td>annually, semester break</td>
</tr>
<tr>
<td>Module capacity</td>
<td>12</td>
</tr>
<tr>
<td>Reference text</td>
<td>Usually held in the break before summer term</td>
</tr>
<tr>
<td></td>
<td>Outsourced to STELS-OL (Scientific and Technical English Language Service); native English speaker with in-depth neuroscience knowlg.</td>
</tr>
</tbody>
</table>

| Modulelevel / module level | |
|----------------------------||
| Modulart / typ of module  | |
| Lehr-/Lernform / Teaching/Learning method | |
| Vorkenntnisse / Previous knowledge | minimum English level B2 (C1 preferred) according to Common European Framework of Reference for Languages (CEFR) |
|                                | priority to non-native speakers, higher semester |

<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
</thead>
</table>

55 / 63
<table>
<thead>
<tr>
<th>Examination</th>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final exam of module</td>
<td>within 2 months of completing the course</td>
<td>Portfolio: 70% several quick tests, texts, presentations, 30% term paper, Bonus system for active participation</td>
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</table>

<table>
<thead>
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<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
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<td>WiSe</td>
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<tr>
<td>Exercises</td>
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<td>WiSe</td>
<td>49</td>
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</table>

**Präsenzzeit Modul insgesamt** 56 h
## gsw210 - Scientific Communication

<table>
<thead>
<tr>
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<th>Scientific Communication</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw210</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>

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

### Zuständige Personen
- Plösch, Torsten (module responsibility)
- Plösch, Torsten (Prüfungsberechtigt)
- Gibbs, Bernhard (Prüfungsberechtigt)
- Dömer, Patrick (Prüfungsberechtigt)
- Dittmann, Tim (Prüfungsberechtigt)

### Prerequisites
- Enrolment in Master’s programme Molecular Biomedicine

### Skills to be acquired in this module
#### Goals of the module:
Upon completion of this module, students
- have improved their competencies in scientific writing
- demonstrate effective communication and presentation skills (oral and written)
- can defend their findings in scientific discussions or rebuttal letters
- know about major communication pitfalls

#### Competencies:
- ++ scientific writing
- ++ data presentation and discussion
- + independent searching and knowledge of scientific literature
- + teamwork
- + critical and analytical thinking

### Module contents
#### Seminar:
- Introduction to scientific writing (analysis of scientific publications, structure of publications, common mistakes, logical story plots)
- types of scientific communications: posters, oral presentations, journal papers, grant applications, CV/job application
- Literature management (information search, literature management tools, plagiarism)
- presentation techniques (how to structure your poster/presentation, how to reach your audience)
- how to write your Master’s thesis
- job application (CV, application letter)
- how do others perceive your message?
- “don’ts” of scientific communication
- social media for scientists
- the perfect abstract

#### Exercise
- analysis of scientific publications
- writing an abstract
- presentation (poster, short talk)

### Literatureempfehlungen
A list will be distributed on forehand

### Links
- [Language of instruction](#): English
- [Duration (semesters)](#): 1 Semester
- [Module frequency](#): winter term
- [Module capacity](#): 12
- [Reference text](#): The number of participants for this module is limited to 12. If there are more students registered than places available, lots will be drawn. Students which are enrolled in Master’s programme Molecular Biomedicine will be preferred.

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

#### Modulart / typ of module
Wahlpflicht / Elective

#### Lehr-/Lernform / Teaching/Learning method
Seminar and Exercise

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

### Examination
<table>
<thead>
<tr>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
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</thead>
<tbody>
<tr>
<td>during seminar</td>
<td>portfolio (presentation, several exercises, active participation during discussions)</td>
</tr>
<tr>
<td><strong>Form of instruction</strong></td>
<td>Seminar und Übung</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>SWS</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>56 h</td>
</tr>
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</table>
### gsw220 - Bioinformatics and Omics

<table>
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<tr>
<th>Module label</th>
<th>Bioinformatics and Omics</th>
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<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw220</td>
</tr>
<tr>
<td>Credit points</td>
<td>6.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>180 h</td>
</tr>
</tbody>
</table>

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

**Zuständige Personen**
- Hitz, Marc-Phillip (module responsibility)
- Gieldon, Laura (Prüfungsberechtigt)
- Hitz, Marc-Phillip (Prüfungsberechtigt)
- Audain Martinez, Enrique (Prüfungsberechtigt)

**Prerequisites**
- Enrolment in Master's programme Molecular Biomedicine

**Skills to be acquired in this module**

**Module contents**

**Literaturempfehlungen**
- Literature will be provided during the lecture/seminar;
- A list will be distributed on forehand

**Links**

**Languages of instruction**

**Duration (semesters)**
- 1 Semester

**Module frequency**

**Module capacity**
- 25

**Modulart / typ of module**

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

**Vorkenntnisse / Previous knowledge**

**Examination**

**Prüfungszeiten**
- Final exam of module will be announced in class; at the end of the course

**Type of examination**
- Portfolio (exercises, active participation during discussions)

**Form of instruction**

<table>
<thead>
<tr>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>--</td>
<td>28</td>
</tr>
</tbody>
</table>

**Präsenzzeit Modul insgesamt**
- 56 h
**gsw215 - Introduction to Academic Writing**

<table>
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<th>Introduction to Academic Writing</th>
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</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>gsw215</td>
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<tr>
<td>Credit points</td>
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<tr>
<td>Workload</td>
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<tr>
<td></td>
<td>(Seminar 1SWS  Übung 1SWS)</td>
</tr>
<tr>
<td>Verwendbarkeit des Moduls</td>
<td>Master's Programme Molecular Biomedicine (Master) &gt; Skills Modules</td>
</tr>
<tr>
<td>Zuständige Personen</td>
<td>Helgers, Simeon (module responsibility)</td>
</tr>
<tr>
<td></td>
<td>Dömer, Patrick (Prüfungsberechtigt)</td>
</tr>
<tr>
<td></td>
<td>Helgers, Simeon (Prüfungsberechtigt)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Enrolment in Master’s programme Molecular Biomedicine</td>
</tr>
</tbody>
</table>

**Skills to be acquired in this module**

- Goals of this module:
  - Upon successful completion of this module, students are familiar with the basic principles of academic practice including academic writing, data analysis, data presentation and general rules regarding ethics and laws.
  - Skills to be acquired/ competencies:
    - **Independent searching and knowledge of scientific literature**
    - **Ethics and professional behavior**
    - **Data presentation and discussion (written and spoken)**
    - **Data analysis skills**
    - **Deepened knowledge of biological working methods**
    - **Critical and analytical thinking**
    - **Interdisciplinary thinking**
    - **Teamwork**

**Module contents**

- The module focuses on the basic principles of academic practice. In theoretical and practical parts, the students will:
  - learn how to structure and write protocols, articles, and thesis.
  - be introduced to general guidelines, plagiarism, national and international guidelines and good scientific practice.
  - learn how to manage, analyze, and present data sets in written and spoken form.
  - learn to work with scientific images/plots etc.
  - be introduced to application writing (ethical approvals, grand applications etc.)
  - learn about authorship and the process of publications.
- The module will consist of lectures and practical parts consisting of lab work, data analysis and writing assignments.

**Literaturempfehlungen**

**Links**

**Language of instruction**

**English**

**Duration (semesters)**

1 Semester

**Module frequency**

25

**Module level / module level**

**Modulart / typ of module**

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

**Vorkenntnisse / Previous knowledge**

**Examination**

<table>
<thead>
<tr>
<th>Prüfungszeiten</th>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF Portfolio: (presentation, written protocol, active participation) - ungraded</td>
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</tr>
</tbody>
</table>

**Form of instruction**

<table>
<thead>
<tr>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload of compulsory attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar</td>
<td>1</td>
<td>SoSe oder WiSe</td>
<td>0</td>
</tr>
<tr>
<td>Exercises</td>
<td>1</td>
<td>SoSe oder WiSe</td>
<td>0</td>
</tr>
</tbody>
</table>

**Präsenzzeit Modul insgesamt**

0 h
## Masterabschlussmodul

mam - Master Thesis Module

<table>
<thead>
<tr>
<th>Module label</th>
<th>Master Thesis Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulkürzel</td>
<td>mam</td>
</tr>
<tr>
<td>Credit points</td>
<td>30.0 KP</td>
</tr>
<tr>
<td>Workload</td>
<td>900 h</td>
</tr>
</tbody>
</table>

*attendance in the lab meetings: 28 hours (2 SWS); theses work: 872 hours*

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

### Zuständige Personen
- all teachers of the curriculum

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

### Skills to be acquired in this module
- ++ deepened biological and / or clinical expertise,
- ++ deepened knowledge of biological working methods and / or clinical diagnostics,
- ++ 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 (written and spoken),
- + team work, + ethics and professional behaviour,
- ++ project and time management

### Module contents
Preparation of the Master Thesis. There are several options for the lab projects, e.g. in the broad categories of:

- https://uol.de/en/neurosciences/
- https://uol.de/en/biochemistry/research/
- https://uol.de/en/neurogenetics/research/
- https://uol.de/en/retina/research/
- https://uol.de/humanmedizin/
- https://uol.de/anatomie/forschung/
- https://uol.de/dermatologie/forschung/
- https://uol.de/humangenetik/research-and-clinical-collaborations/
- https://uol.de/genetik-gehirnfehlbildungen/forschungsschwerpunkte/

### Literatureempfehlungen
Specific literature of the topics indicated above; original papers related to the current research question

### Links
- Language of instruction: English
- Duration (semesters): 1 Semester
- Module frequency: recommended in semester 4, time is flexible and subject to individual arrangement
- Module capacity: unlimited
- Modullevel / module level: Abschlussmodul (Abschlussmodul / Conclude)
- Modulart / typ of module: Pflicht / Mandatory

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

<table>
<thead>
<tr>
<th>Vorkenntnisse / Previous knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination</td>
</tr>
<tr>
<td>Prüfungszeiten</td>
</tr>
<tr>
<td>Type of examination</td>
</tr>
<tr>
<td>Final exam of module</td>
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</tbody>
</table>

Master Thesis (90%), oral presentation (colloquium, 10%)
<table>
<thead>
<tr>
<th><strong>Form of instruction</strong></th>
<th><strong>Colloquium</strong></th>
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<tbody>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>SoSe oder WiSe</td>
</tr>
<tr>
<td><strong>Workload Präsenzzeit</strong></td>
<td>28 h</td>
</tr>
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</table>