Module Descriptions

Master of Science Biology

Examination Regulations in the Version of: 2011
## Index

### Compulsory Modules

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Bioscience</td>
<td>1</td>
</tr>
<tr>
<td>Biodiversity and Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Neurobiology - Master</td>
<td>7</td>
</tr>
<tr>
<td>Advanced Methods</td>
<td>9</td>
</tr>
</tbody>
</table>

### Master Thesis

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Thesis</td>
<td>11</td>
</tr>
</tbody>
</table>

### Special Subjects

#### Molecular Bioscience

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Biosciences</td>
<td></td>
</tr>
<tr>
<td>Patent Law</td>
<td>13</td>
</tr>
<tr>
<td>Medical Products</td>
<td>15</td>
</tr>
<tr>
<td>Quality Control</td>
<td>17</td>
</tr>
</tbody>
</table>

#### Molecular Biosciences - Compulsory Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbiology - Master</td>
<td>19</td>
</tr>
<tr>
<td>Molecular Botany</td>
<td>22</td>
</tr>
<tr>
<td>Endocrinology</td>
<td>24</td>
</tr>
<tr>
<td>Genetics</td>
<td>26</td>
</tr>
<tr>
<td>Conservation Genomics and Molecular Biology</td>
<td>28</td>
</tr>
<tr>
<td>Protein Biochemistry</td>
<td>29</td>
</tr>
</tbody>
</table>

#### Neurobiology

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Neurobiology</td>
<td>31</td>
</tr>
<tr>
<td>Tropical Conservation V - Universidad de Costa Rica</td>
<td>33</td>
</tr>
<tr>
<td>Tropical Botany V - Universidad de Costa Rica</td>
<td>35</td>
</tr>
<tr>
<td>Tropical Ecology V - Universidad de Costa Rica</td>
<td>37</td>
</tr>
<tr>
<td>Tropical Zoology V - Universidad de Costa Rica</td>
<td>39</td>
</tr>
<tr>
<td>Behavioral Physiology</td>
<td>41</td>
</tr>
</tbody>
</table>

#### Biodiversity and Ecology

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Statistics for Biologists</td>
<td>43</td>
</tr>
<tr>
<td>Excursion</td>
<td>45</td>
</tr>
<tr>
<td>Tropical Conservation I - Universidad de Costa Rica</td>
<td>47</td>
</tr>
<tr>
<td>Tropical Botany I - Universidad de Costa Rica</td>
<td>49</td>
</tr>
<tr>
<td>Tropical Ecology I - Universidad de Costa Rica</td>
<td>51</td>
</tr>
<tr>
<td>Tropical Zoology I - Universidad de Costa Rica</td>
<td>53</td>
</tr>
<tr>
<td>Course</td>
<td>Page</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Advanced Systematics</td>
<td>55</td>
</tr>
<tr>
<td>Chemical Ecology</td>
<td>57</td>
</tr>
<tr>
<td>Evolutionary Ecology: Interactions of Organisms</td>
<td>59</td>
</tr>
<tr>
<td>Conservation Genomics</td>
<td>61</td>
</tr>
<tr>
<td>Tropical Conservation II - Universidad de Costa Rica</td>
<td>63</td>
</tr>
<tr>
<td>Tropical Conservation IV - Universidad de Costa Rica</td>
<td>65</td>
</tr>
<tr>
<td>Ecology of the Mediterranean</td>
<td>67</td>
</tr>
<tr>
<td>Ecology of Tropical Habitats</td>
<td>69</td>
</tr>
<tr>
<td>Soil and Water</td>
<td>71</td>
</tr>
<tr>
<td>Field Ecology II</td>
<td>73</td>
</tr>
<tr>
<td>Field Ecology III</td>
<td>75</td>
</tr>
<tr>
<td>Tropical Botany II - Universidad de Costa Rica</td>
<td>77</td>
</tr>
<tr>
<td>Tropical Botany IV - Universidad de Costa Rica</td>
<td>79</td>
</tr>
<tr>
<td>Tropical Ecology II - Universidad de Costa Rica</td>
<td>81</td>
</tr>
<tr>
<td>Tropical Ecology IV - Universidad de Costa Rica</td>
<td>83</td>
</tr>
<tr>
<td>Tropical Zoology II - Universidad de Costa Rica</td>
<td>85</td>
</tr>
<tr>
<td>Tropical Zoology IV - Universidad de Costa Rica</td>
<td>87</td>
</tr>
<tr>
<td>Wetland Ecology</td>
<td>89</td>
</tr>
</tbody>
</table>

**Molecular Bioscience with Neurobiology**

**Molecular Biosciences**

- Patent Law                                         | 92   |
- Medical Products                                    | 94   |
- Quality Control                                     | 96   |

**Molecular Biosciences - Compulsory Electives**

- Microbiology - Master                               | 98   |
- Molecular Botany                                     | 101  |
- Endocrinology                                       | 103  |
- Genetics                                            | 105  |
- Conservation Genomics and Molecular Biology         | 107  |
- Protein Biochemistry                                | 108  |

**Neurobiology - Compulsory Electives**

- Advanced Neurobiology                              | 110  |
- Behavioral Physiology                               | 112  |

**Molecular Bioscience with Biodiversity/Ecology**

**Molecular Biosciences**

- Patent Law                                         | 114  |
- Medical Products                                    | 116  |
- Quality Control                                     | 118  |
Molecular Biosciences - Compulsory Electives

Microbiology - Master 120
Molecular Botany 123
Endocrinology 125
Genetics 127
Conservation Genomics and Molecular Biology 129
Protein Biochemistry 130

Biodiversity/Ecology - Compulsory Electives

Advanced Systematics 132
Chemical Ecology 134
Evolutionary Ecology: Interactions of Organisms 136
Conservation Genomics 138
Tropical Conservation II - Universidad de Costa Rica 140
Tropical Conservation IV - Universidad de Costa Rica 142
Ecology of the Mediterranean 144
Ecology of Tropical Habitats 146
Soil and Water 148
Field Ecology II 150
Field Ecology III 152
Tropical Botany II - Universidad de Costa Rica 154
Tropical Botany IV - Universidad de Costa Rica 156
Tropical Ecology II - Universidad de Costa Rica 158
Tropical Ecology IV - Universidad de Costa Rica 160
Tropical Zoology II - Universidad de Costa Rica 162
Tropical Zoology IV - Universidad de Costa Rica 164
Wetland Ecology 166

Neurobiology with Molecular Biosciences

Molecular Biosciences - Compulsory Electives

Microbiology - Master 169
Molecular Botany 172
Endocrinology 174
Genetics 176
Conservation Genomics and Molecular Biology 178
Protein Biochemistry 179

Compulsory Elective

Patent Law 181
Medical Products 183
Quality Control 185
Basic Statistics for Biologists 187
Excursion 189
### Neurobiology - Compulsory Electives

- Advanced Neurobiology: 191
- Behavioral Physiology: 193

### Neurobiology with Biodiversity/Ecology

#### Compulsory Elective

- Patent Law: 195
- Medical Products: 197
- Quality Control: 199
- Basic Statistics for Biologists: 201
- Excursion: 203

#### Biodiversity/Ecology - Compulsory Electives

- Advanced Systematics: 209
- Chemical Ecology: 211
- Evolutionary Ecology: Interactions of Organisms: 213
- Conservation Genomics: 215
- Tropical Conservation II - Universidad de Costa Rica: 217
- Tropical Conservation IV - Universidad de Costa Rica: 219
- Ecology of the Mediterranean: 221
- Ecology of Tropical Habitats: 223
- Soil and Water: 225
- Field Ecology II: 227
- Field Ecology III: 229
- Tropical Botany II - Universidad de Costa Rica: 231
- Tropical Botany IV - Universidad de Costa Rica: 233
- Tropical Ecology II - Universidad de Costa Rica: 235
- Tropical Ecology IV - Universidad de Costa Rica: 237
- Tropical Zoology II - Universidad de Costa Rica: 239
- Tropical Zoology IV - Universidad de Costa Rica: 241
- Wetland Ecology: 243

### Biodiversity and Ecology with Molecular Biosciences

#### Biodiversity/Ecology

- Basic Statistics for Biologists: 246
- Excursion: 248
- Tropical Conservation I - Universidad de Costa Rica - ungraded: 250
- Tropical Botany I - Universidad de Costa Rica - ungraded: 252
- Tropical Ecology I - Universidad de Costa Rica - ungraded: 254
Molecular Biosciences - Compulsory Electives

- Microbiology - Master
- Molecular Botany
- Endocrinology
- Genetics
- Conservation Genomics and Molecular Biology
- Protein Biochemistry

Biodiversity/Ecology - Compulsory Electives

- Advanced Systematics
- Chemical Ecology
- Evolutionary Ecology: Interactions of Organisms
- Conservation Genomics
- Tropical Conservation II - Universidad de Costa Rica
- Tropical Conservation IV - Universidad de Costa Rica
- Ecology of the Mediterranean
- Ecology of Tropical Habitats
- Soil and Water
- Field Ecology II
- Field Ecology III
- Tropical Botany II - Universidad de Costa Rica
- Tropical Botany IV - Universidad de Costa Rica
- Tropical Ecology II - Universidad de Costa Rica
- Tropical Ecology IV - Universidad de Costa Rica
- Tropical Zoology II - Universidad de Costa Rica
- Tropical Zoology IV - Universidad de Costa Rica
- Wetland Ecology

Biodiversity and Ecology with Neurobiology

Biodiversity/Ecology

- Basic Statistics for Biologists
- Excursion
- Tropical Conservation I - Universidad de Costa Rica - ungraded
- Tropical Botany I - Universidad de Costa Rica - ungraded
- Tropical Ecology I - Universidad de Costa Rica - ungraded
- Tropical Zoology I - Universidad de Costa Rica - ungraded

Neurobiology - Compulsory Electives

- Advanced Neurobiology
- Behavioral Physiology

Biodiversity/Ecology - Compulsory Electives

- Advanced Systematics
<table>
<thead>
<tr>
<th>Course</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Ecology</td>
<td>325</td>
</tr>
<tr>
<td>Evolutionary Ecology: Interactions of Organisms</td>
<td>327</td>
</tr>
<tr>
<td>Conservation Genomics</td>
<td>329</td>
</tr>
<tr>
<td>Tropical Conservation II - Universidad de Costa Rica</td>
<td>331</td>
</tr>
<tr>
<td>Tropical Conservation IV - Universidad de Costa Rica</td>
<td>333</td>
</tr>
<tr>
<td>Ecology of the Mediterranean</td>
<td>335</td>
</tr>
<tr>
<td>Ecology of Tropical Habitats</td>
<td>337</td>
</tr>
<tr>
<td>Soil and Water</td>
<td>339</td>
</tr>
<tr>
<td>Field Ecology II</td>
<td>341</td>
</tr>
<tr>
<td>Field Ecology III</td>
<td>343</td>
</tr>
<tr>
<td>Tropical Botany II - Universidad de Costa Rica</td>
<td>345</td>
</tr>
<tr>
<td>Tropical Botany IV - Universidad de Costa Rica</td>
<td>347</td>
</tr>
<tr>
<td>Tropical Ecology II - Universidad de Costa Rica</td>
<td>349</td>
</tr>
<tr>
<td>Tropical Ecology IV - Universidad de Costa Rica</td>
<td>351</td>
</tr>
<tr>
<td>Tropical Zoology II - Universidad de Costa Rica</td>
<td>353</td>
</tr>
<tr>
<td>Tropical Zoology IV - Universidad de Costa Rica</td>
<td>355</td>
</tr>
<tr>
<td>Wetland Ecology</td>
<td>357</td>
</tr>
</tbody>
</table>

**Biological or Medical Subsidiary Subject**

**Special Subject**

- Advanced Neurobiology                                             | 360  |
- Microbiology - Master                                              | 362  |
- Chemical Ecology                                                   | 365  |
- Molecular Botany                                                   | 367  |
- Evolutionary Ecology: Interactions of Organisms                    | 369  |
- Endocrinology                                                      | 371  |
- Ecology of the Mediterranean                                       | 373  |
- Ecology of Tropical Habitats                                       | 375  |
- Protein Biochemistry                                               | 377  |
- Field Ecology II                                                   | 379  |
- Tropical Ecology IV - Universidad de Costa Rica                    | 381  |
- Behavioral Physiology                                              | 383  |

**Biochemistry - Subsidiary Subject**

- Biochemistry Subsidiary Subject                                   | 385  |

**Biometry - Subsidiary Subject**

- Subsidiary Subject Biometry                                        | 387  |

**Biophysics - Subsidiary Subject**

**Human Genetics - Subsidiary Subject**

- Human Genetics                                                     | 389  |

**Medical Neuroscience - Subsidiary Subject**
Medical Neuroscience II

**Pharmacology and Toxicology - Subsidiary Subject**

Pharmacology and Toxicology II - Master Biology and Biochemistry

**Virology - Subsidiary Subject**

Virology II

**Non-Biological Subsidiary Subject**

**Bioinformatics and Systems Biology - Subsidiary Subject**

Introductions to Bioinformatics
Information and Systems Theory in Life Sciences

**Chemistry - Subsidiary Subject**

Chemistry

**Computer Science - Subsidiary Subject**

Introduction to Computer Science and Programming I and II

**Mathematics - Subsidiary Subject**

Applied Stochastics I
Subsidiary Subject Mathematics for Master in Biology
Medical Statistics and Biometrics

**Conservation - special subject**

Tropical Conservation III - Universidad de Costa Rica
Tropical Botany III - Universidad de Costa Rica
Tropical Ecology III - Universidad de Costa Rica
Tropical Zoology III - Universidad de Costa Rica

**Philosophy - Subsidiary Subject**

Basics Philosophy A with 10 ECTS
Basics Philosophy A with 4 ECTS
Basics Philosophy A with 6 ECTS
Basics Philosophy B with 4 ECTS
Basics Philosophy B with 6 ECTS
Basics Philosophy C with 4 ECTS

**Psychology - Subsidiary Subject**

Psychology - Subsidiary Subject

Compulsory Modules in Subsidiary Subject Psychology
Testing Theory and Experimental Design

**Psychology - Subsidiary Subject**

Differential Psychology
<table>
<thead>
<tr>
<th>Course</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Psychology</td>
<td>442</td>
</tr>
<tr>
<td>Clinical Psychology I - Bachelor</td>
<td>444</td>
</tr>
<tr>
<td>Methods of Health Psychology</td>
<td>447</td>
</tr>
<tr>
<td>Neuropsychology</td>
<td>449</td>
</tr>
<tr>
<td>Social Psychology I</td>
<td>451</td>
</tr>
<tr>
<td>Social Psychology II</td>
<td>453</td>
</tr>
<tr>
<td>Lecture General Psychology Ib</td>
<td>455</td>
</tr>
<tr>
<td>General Psychology II, Lecture</td>
<td>457</td>
</tr>
<tr>
<td>Lecture Biological Psychology</td>
<td>459</td>
</tr>
<tr>
<td>Lecture Developmental Psychology</td>
<td>461</td>
</tr>
<tr>
<td>Lecture General Psychology Ia</td>
<td>463</td>
</tr>
</tbody>
</table>

**Thinking about Science - Subsidiary Subject**

<table>
<thead>
<tr>
<th>Course</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>German</td>
<td>465</td>
</tr>
<tr>
<td>Elective Module</td>
<td>467</td>
</tr>
<tr>
<td>Thinking about Science</td>
<td>469</td>
</tr>
</tbody>
</table>

**Management and Economics - Subsidiary Subject**

<table>
<thead>
<tr>
<th>Course</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Business Administration</td>
<td>471</td>
</tr>
<tr>
<td>Introduction to Economics</td>
<td>473</td>
</tr>
<tr>
<td>Molecular Biology for Conservation Genomics A - graded</td>
<td>475</td>
</tr>
<tr>
<td>Molecular Biology for Conservation Genomics A - ungraded</td>
<td>477</td>
</tr>
<tr>
<td>Molecular Biology for Conservation Genomics B - graded</td>
<td>479</td>
</tr>
<tr>
<td>Molecular Biology for Conservation Genomics B - ungraded</td>
<td>481</td>
</tr>
</tbody>
</table>
Molecular Bioscience
Modules referring to Compulsory Modules

Code 8802670552

ECTS credits 5

Attendance time 4

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Anita Marchfelder

Instructor(s) apl. Prof. Dr. Stefan Binder, Prof. Dr. Anita Marchfelder, Dr. Frank Bengelsdorf

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory module, 1st study semester;

Biology MSc, start of studies: winter semester, compulsory module, 1st study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Students who have successfully completed this module

• have an in-depth knowledge about important aspects of modern plant molecular biology and plant biotechnology as well as biotechnology of prokaryotes.
• have a solid knowledge about the most important basic techniques of general molecular biology and of plant molecular biology and its use to elucidate complex processes in a living cell.
• are capable to assess the limits of molecular approaches in botany and microbiology with the help of examples.
• possess expertise to judge and deliberate applied developments in green and white gene technology on a scientific up to date level concerning the practical relevance and its benefit and risk, respectively.

Syllabus This module covers the following subject-specific topics:

Lecture Molecular Bioscience / Molecular biology and gene technology of plants:
• Modern aspects of plant molecular biology and plant biotechnology including important techniques for molecular biology research in plants. Special focus is on plant specific techniques like plant transformation and approaches to identify plant genes and their functions.
• Current examples from applied plant biotechnology.

Lecture Molecular Bioscience / Microbiology:

• DNA transfer in bacteria: transformation, transduction, conjugation
• Structure and construction of plasmids and vectors, transfer of recombinant DNA in bacteria, verification of genetically modified organisms
• „blotting-methods“ for detection of DNA, RNA und proteins
• Detection of recombinant proteins using SDS-PAGE and „Western-Blot“
• Sequencing of nucleic acids and data management, methods of Sanger sequencing, 454-pyro sequencing, Illumina sequencing, PacBio sequencing, and nanopore sequencing
• Introducing of the data bank systems such as NCBI und EBI as well as the analysis of DNA sequences: sequence alignments, reconstruction of phylogenetic trees, bacterial genome sequences, metagenomes and metatranscriptomes of environmental samples

Literature

Lecture Molecular Bioscience / Molecular biology and gene technology of plants:

• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists

Lecture Molecular Bioscience / Microbiology:

• Lecturers provide chalkboard writing, mention relevant data bases
• Clark und Held: Molecular Biology: Das Original mit Übersetzungshilfen: Understanding the Genetic Revolution (SAV Biowissenschaften), Auflage: 1, Spektrum Verlag;
• Pevsner, J: Bioinformatics and Functional Genomics (Englisch), Auflage: 2, John Wiley & Sons

Teaching and learning methods

• Molecular Bioscience / Molecular biology and gene technology of plants (lecture), 3 credit hours [SWS], 3 credit points [LP]
• Molecular Bioscience / Microbiology (lecture), 1 credit hour [SWS], 2 credit points [LP]

Workload

Attendance: 60 h
Private study: 90 h
Sum: 150 h

Assessment

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.
Basis for Modules Molecular Botany [Molekulare Botanik], Microbiology (Master) [Mikrobiologie (Master)], Endocrinology [Endokrinologie], Genetics [Genetik]
**Biodiversity and Ecology**

Modules referring to Compulsory Modules

<table>
<thead>
<tr>
<th>Code</th>
<th>8802670554</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS credits</td>
<td>3</td>
</tr>
<tr>
<td>Attendance time</td>
<td>2</td>
</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Manfred Ayasse</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Manfred Ayasse, Prof. Dr. Simone Sommer, Prof. Dr. Steven Jansen, Prof. Dr. Marian Kazda</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory module, 1\textsuperscript{st} study semester</td>
</tr>
</tbody>
</table>

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module

- know about the historical origin of the term evolution and its change in meaning over time.
- are familiar with the terminology and procedures of evolutionary biology, ecology and biodiversity.
- have knowledge of the specific terminology of phylogenetic classification and the ability to apply those principles for any group of organisms they come across.
- know about the phylogeny within the Metazoa and can back this information with their knowledge of evolution and phylogenetics.
- have acquaintance with the most important forms of interactions between organisms and the effects of natural selection, intra- and interspecific concurrence and adaptation.
- have information about cycles in ecosystems and stress physiology.
- achieved the capability to evaluate reactions of organisms to their surroundings.
- attained an overview of the various different ecosystems found on earth (forests, mangroves, deserts, wetlands).
- have knowledge about the effects of increasing disturbance of ecosystems and species communities
know the most important ecosystem services and their global importance
have an overview about the role of genetic diversity for the survival of animal populations
have realized the interactions and driving mechanisms between global change and loss of biodiversity
know about the most important relationships between climate and plants.
have the ability to draw conclusions about climatic conditions using information from fossil plant material.
understand the development of adaptations of the xylem of plants and its ecological importance.
understand the various past eras of mass extinction and proof for the present concern about global climate change.

Syllabus

This module covers the following subject-specific topics:

- Systematics, evolutionary biology, ecology and biodiversity and use of modern methods
- Biospheres (climate, vegetation, animal communities)
- Anthropocene: indices of global change, loss of ecosystem services and EcoHealth
- Stress ecophysiology, adaptation of plants
- Introduction to animal-plant interactions (competition, predation, parasitism, herbivory, mutualism)
- Communication and chemical ecology
- Reciprocity between climate and plants
- Evolution of the water transport system in terrestrial plants: the first fossil terrestrial plants and functional anatomy of the modern vascular tissue
- Convergence in the susceptibility of trees to drought and the climate change

Literature

- provided script „The evolution of water transport in plants: an evolutionary approach of structure-function relationships”
- Handouts of the lectures

Teaching and learning methods

- Biodiversity and Ecology: Adaptations in a changing world (lecture), 2 credit hours [SWS], 3 credit points [LP]

Workload

- Attendance: 30 h
- Private study: 60 h
- Sum: 90 h

Assessment

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.
Basis for

Further modules in special subject Biodiversity and Ecology
Neurobiology - Master

Modules referring to Compulsory Modules

<table>
<thead>
<tr>
<th>Code</th>
<th>8802670553</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS credits</td>
<td>3</td>
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<td>2</td>
</tr>
<tr>
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</tr>
<tr>
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<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory module, 1st study semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None; preferably basic knowledge in neurobiology from bachelor program.</td>
</tr>
</tbody>
</table>
| Learning objectives | Students who have successfully completed this module
  - have basic knowledge of structural and functional properties of the nervous systems in animals and humans.
  - have acquired good knowledge of synaptic processes and their pharmacology, and of neurotransmitters and their receptors.
  - have gained an understanding of sensorimotor transitions, general motor control, structure and function of sense organs, neural mechanisms of behavior control, including learning. |
| Syllabus           | This module covers the following subject-specific topics:
  - Overview of important structural and functional properties of nervous systems
  - Synaptic transmission, effects of neurotransmitters and their receptors, intracellular cascades of signal transduction, synaptic processes of learning
  - Examples of sensory perception, processing and information representation in brains of different complexity; mechanisms of motor control in pattern generation and reflex regulation |
Literature

- Reichert, H.: *Neurobiologie*, Thieme-Verlag, Stuttgart

Teaching and learning methods

- Neurobiology (lecture), 2 credit hours [SWS], 3 credit points [LP]

Workload

- Attendance: 30 h
- Private study: 60 h
- Sum: 90 h

Assessment

- The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure

- The grade of the module will be the grade of the exam.

Basis for

- Modules Behavioral Physiology [Verhaltensphysiologie], Advanced Neurobiology [Spezielle Neurobiologie]
### Advanced Methods

**Modules referring to Compulsory Modules**

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<td><strong>Language of instruction</strong></td>
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</tr>
<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Bernhard Eikmanns</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Professors of the Biology institutes (Bio I-VIII)</td>
</tr>
</tbody>
</table>

#### Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory module, 3\textsuperscript{rd} or 4\textsuperscript{th} study semester

#### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: All study-relevant modules prior to this module and the master thesis.

#### Learning objectives

Students who have successfully completed this module

- have detailed knowledge of modern approaches to typical questions in biology.
- have insight into topical research themes.
- have become acquainted with scientific problems (theories and methods).
- are able to do research on a topical theme of the instructing work group, to summarize and discuss their results in a protocol (lab journal) and oral presentation.
- are able to judge their action on the basis of effective regulations.
- have trained their team-work skills.

#### Syllabus

This module covers the following subject-specific topics:

- The advanced laboratory course is carried out in a study group. Topic and scope are determined in the group from recent questions from the research of the supervising instructor.
- Literature research and literature administration.
- Theoretical exploitation of a scientific topic.
- Methods and scientific equipment used to solve a specific problem
- Project-related elaboration of known methods
- Solving a scientific problem in compliance with the effective safety and environmental regulations in the lab; laboratory animal science, if applicable.
- Independent research on a specific scientific question after instruction by the supervising group.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Subject-specific literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching and learning methods</td>
<td>Advanced Laboratory Course Special Methods [Spezielle Methoden für Fortgeschrittene] (laboratory course), 10 credit hours [SWS], 10 credit points [LP]</td>
</tr>
<tr>
<td>Workload</td>
<td>Attendance: 150 h</td>
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<tr>
<td></td>
<td>Private study: 150 h</td>
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<td></td>
<td>Sum: 300 h</td>
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<tr>
<td>Assessment</td>
<td>Usually oral presentation</td>
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<tr>
<td>Grading procedure</td>
<td>The module is not graded.</td>
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<tr>
<td>Basis for</td>
<td>Master Thesis</td>
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Master Thesis
Modules referring to Master Thesis

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Bernhard Eikmanns</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Supervising professor</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**  
Biology MSc, start of studies: winter semester, compulsory module, 4th study semester

**Recommended prerequisites**  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Corresponding compulsory and compulsory elective modules of the study course.

**Learning objectives**  
Students who have successfully completed this module

- are able to elaborate on a scientific question from the field of biology on the basis of known technologies and document their results (in writing and oral presentation) in accordance with the Guidelines of Research Integrity and Good Scientific Practice.
- are able to present a research project in the scientific context and to discuss their methods and approaches in the broader scientific community.
- plan further research and additional investigations on the basis of the results achieved and knowledge gained.
- act in compliance with the effective health, safety and environmental regulations.
- have learned common methods of literature research, data administration and data processing.
- have acquired soft skills like team-work, intercultural capacities and adequate time-management.

**Syllabus**  
This module covers the following subject-specific topics:
• Common methods of literature research, data administration and data processing
• Experimental design, setup, documentation
• Interpretation of results in the context of topical scientific literature
• Discussion of results in the broader scientific community
• Implementation of results into new approaches
• Critical analysis of methods
• Guidelines of scientific publishing
• Safety, health and environmental protection, hazard exposure assessment, animal protection
• Time management
• Team work
• Self-organization

**Literature**
Subject-specific literature

**Teaching and learning methods**
• Master thesis [Masterarbeit], 30 credit hours [SWS], 30 credit points [LP]

**Workload**
Attendance: 450 h
Private study: 450 h
Sum: 900 h

**Assessment**
The master thesis is graded by two university professors.

**Grading procedure**
The final grade is the arithmetic means of the two grades.

**Basis for**
Graduation master program
### Patent Law

**Modules referring to Molecular Biosciences**

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<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Dean of studies (chemistry department)</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Helmut Reitzle</td>
</tr>
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**Allocation of study programmes**
- Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester;
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: None.

**Learning objectives**
- Students who have successfully completed this module
  - have knowledge about the fundamentals of the patent system.

**Syllabus**
- This module covers the following subject-specific topics:
  - Part 1: Rights of use, exhaustion of rights of use using powers, mediate patent infringement, right of prior use, restriction of the effect of the patent, extend of protection, infringement of the protective right, the rights to the invention.
  - Part 2: Novelty, the inventive step, industrial application.
  - Part 3: procedural law, general rules, representation, patent application, procedure up to granting, eliminations of patents, objection, nullity.

**Literature**
- Literature will be provided in the lecture
<table>
<thead>
<tr>
<th><strong>Teaching and learning methods</strong></th>
<th>• Patent Right for Natural Scientists [Patentrecht für Naturwissenschaftler] (lecture), 1 credit hour [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>
| **Workload**                  | Attendance: 15 h  
Private study: 75 h  
Sum: 90 h |
| **Assessment**                | Compulsory attendance, absence on maximally one appointment is tolerated (except excursion) |
| **Grading procedure**         | The module is not graded. |
| **Basis for**                 | - |
Medical Products
Modules referring to Molecular Biosciences

**Code** 8802671712

**ECTS credits** 3

**Attendance time** 1

**Language of instruction** German

**Duration** 1 Semester

**Cycle** each Winter Semester

**Coordinator** Prof. Dr. Peter Gierschik

**Instructor(s)** Dr. Thomas Bräuner, Dr. Dieter Eckhardt, Dr. Karl Heinz Emmert, Dr. Armin Frey, Prof. Dr. Peter Gierschik, Dr. Udo Hartlaub, Dr. Thomas Kammermeier, Dr. Thomas Lamprecht, Dr. Eberhardt Landsbeck, Dr. Rainer Winstel

**Allocation of study programmes** Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester;

Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester

**Recommended prerequisites** Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: No information.

**Learning objectives** Students who have successfully completed this module

- have knowledge about drug development in general, as well as on the level of chemistry/pharmaceutics and pharmacology/toxicology in special, under consideration of corresponding legal rules and standards.
- know the legal requirements for first clinical application of new pharmaceuticals.
- have a clear idea how clinical studies are designed and they know how to interpret and assess corresponding data.
- have knowledge about safety and regulation of pharmaceutical products.

**Syllabus** This module covers the following subject-specific topics:

- Introduction, history of drug development, procedure outline of a drug development, rules and standards
• Chemical/pharmaceutical development I: Development of active pharmaceutical ingredients
• Chemical/pharmaceutical development II: Development of final products
• Pharmacological/toxicological development I: From drug discovery and pre-clinical development to first application on human beings
• Pharmacological/toxicological development II: Toxicology and safety issues of pharmacology
• Pharmacological/toxicological development III: Pharmacokinetics and metabolism
• Clinical development: From first application on human beings to proof of efficiency and safety
• Planning and execution of rules and standards
• Pharmaceutical product information and labeling
• Safety of pharmaceutical products: Basics
• Safety of pharmaceutical products: Structure and risk management
• Biopharmaceutical drugs: Development, production and control
• Generic medicaments: Quality, substitution
• Regulation of pharmaceutical products in Germany
• Regulation of pharmaceutical products in the European Union

Literature

No information

Teaching and learning methods

• W 68 Development, Regulation and Monitoring of Medical Products [W 68 Entwicklung, Zulassung und Überwachung von Arzneimitteln] (seminar), 1 credit hour [SWS], 3 credit points [LP]

Workload

Attendance: 15 h
Private study: 75 h
Sum: 90 h

Assessment

Evidence of course achievement

Grading procedure

The module is not graded.

Basis for

-
# Quality Control

Modules referring to Molecular Biosciences

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<td><strong>Language of instruction</strong></td>
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<td><strong>Duration</strong></td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Summer Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Dr. Frank Rosenau</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Dr. Frank Rosenau, Dr. Frank Bengelsdorf</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Lectures (basic laboratory courses, respectively) in microbiology, biochemistry, chemistry, pharmacy.

**Learning objectives**
- Students who have successfully completed this module
  - possess fundamental knowledge about installation and operation of pharmaceutical productions processes in the scope of legal regulations.
  - are qualified to understand pharmaceutical production by real practical examples.
  - achieve a theoretical preparation to an important potential occupational area.

**Syllabus**
- This module covers the following subject-specific topics:
  - Quality assurance and sterilization/validation of medical devices
  - Development, production and pharmaceutical formulation of therapeutic glycoproteins
  - Bioanalytical methods under GLP conditions
  - Hygienic design of pharmaceutical production facilities
• Chemical quality controls of active agents and additives
• Rules and standards, inspection authorities: GMP and GLP
• Microbiology in the pharmaceutical industry
• New technologies and strategies for analysis of pharmaceutics
• Biotechnological production of biosimilars
• Design of production facilities at various culture techniques and production organisms

Literature
PowerPoint slides from the presentations of the lecturers (incl. cited sources) will be sent to the participants via an email list.

Teaching and learning methods
Quality Management [Qualitätssicherung] (lecture), 2 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 30 h
Private study: 60 h
Sum: 90 h

Assessment
Attendance as evidence of course achievement

Grading procedure
The module is not graded.

Basis for
-
# Microbiology - Master

Modules referring to Molecular Biosciences - Compulsory Electives

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<tr>
<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Bernhard Eikmanns</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).

**Learning objectives**
- Students who have successfully completed this module
  - have extended knowledge on key topics in microbiology and molecular microbiology.
  - have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.
  - have gathered experience in actively discussing scientific presentations
  - have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.
  - are able to individually work under supervision on own topics related to current research.
Syllabus

This module covers the following subject-specific topics:

Lectures:

- **Microbiology IV** (Microbial Regulation):
  RNA: Structure and function: (Ribosomal RNA {rRNA}; Transfer RNA {tRNA}; Messenger RNA {mRNA}; Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction {negative control}; Induction {positive control}; Repression {negative control}; Repression {positive control}; cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition!); Attenuation in *Escherichia coli* {amino acid biosynthesis}; Attenuation (antibiotic resistance induction); Attenuation (pyrimidine biosynthesis); Attenuation in *Bacillus subtilis* {amino acid biosynthesis}; Autogenic control; 2-Component systems (*arc, ntr, che*); FNR-dependent regulation; Sigma factor-dependent regulation (heat shock, nitrogen metabolism, sporulation); T-box-dependent regulation; Regulation by modification of tRNA bases; antisenseRNA-dependent regulation {plasmid replication, osmoregulation}; Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing (*Vibrio harveyi, Staphylococcus aureus*); Regulation by rarely used tRNAs; Stringent response; Signal molecules)
  Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)
- **Host-Microbe Interactions:**
  Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

- **Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense**

Laboratory course (Microbiology Advanced Course):

- **Principles and methods of enrichment, isolation and characterization of microorganisms** (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogens; serological and enzymatic analysis of β-galactosidase in *Escherichia coli*; isolation and analysis of genes from *Acinetobacter* sp. and cloning of these genes; cultivation of *Ashbya gossypii* and analysis of substrate consumption and riboflavin formation by a mutant of this fungus; characterization of a key enzyme of riboflavin synthesis; growth, substrate consumption and glutamate production of *Corynebacterium glutamicum*; analysis of key enzymes of glutamate synthesis
- **Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrech); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment**
Literature

• Ofek I, Hasty DI, Doyle RJ: *Bacterial Adhesion to Animal Cells and Tissues*, ASM Press, USA 2003
• Wilson M: *Bacteriology of Humans – An Ecological Perspective*, Blackwell Publishing USA 2008

Teaching and learning methods

• Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester
• Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester
• Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

Workload

- Attendance: 255 h
- Private study: 285 h
- Sum: 540 h

Assessment

Audited protocol, not graded; Successful participation at the seminar; not graded.

Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

Grading procedure

The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

Basis for

Master thesis in the Institute of Microbiology and Biotechnology
Molecular Botany
Modules referring to Molecular Biosciences - Compulsory Electives

Code 8802670558

ECTS credits 18

Attendance time 17

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator apl. Prof. Dr. Stefan Binder

Instructor(s) apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).

Learning objectives Students who have successfully completed this module

• have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.
• are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.
• are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.
• have expertise to judge and deliberate benefits and risks in green gene technology.

Syllabus This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

Literature
• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition

Teaching and learning methods
• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]
• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of molecular botany
Endocrinology
Modules referring to Molecular Biosciences - Compulsory Electives

<table>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Jan Tuckermann</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Röszer, Dr. Sabine Vettorazzi</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended; Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Molecular Bioscience [Molekulare Biowissenschaften].</td>
</tr>
<tr>
<td>Learning objectives</td>
<td>Students who have successfully completed this module • possess advanced knowledge about key issues in endocrinology and molecular endocrinology. • have the ability for self-dependent preparation of a topic by original papers and to present it in a talk. • are qualified for advanced practical work in a current research project in the area of molecular endocrinology.</td>
</tr>
<tr>
<td>Syllabus</td>
<td>This module covers the following subject-specific topics: • Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue.</td>
</tr>
</tbody>
</table>
- Practice of working techniques in cell biology, protein chemistry and molecular biology.
- Summarizations of results in a work record respectively a poster as well as an oral presentation.

**Literature**
- Current textbooks about biochemistry as well as physiology

**Teaching and learning methods**
- Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance: 240 h
- Private study: 300 h
- Sum: 540 h

**Assessment**
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the Institute of Comparative Molecular Endocrinology
Genetics
Modules referring to Molecular Biosciences - Compulsory Electives

Code 8802670559

ECTS credits 18

Attendance time 16

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Nils Johnsson

Instructor(s) Dr. Alexander Dünkler, Dr. Thomas Gronemeyer, Prof. Dr. Nils Johnsson

Allocation of study programmes
Biochemistry MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in genetics and cell biology; e.g. module Developmental Biology and Genetics [Entwicklungsbiologie und Genetik] (BSc Biology), module Microbiology and Genetics [Mikrobiologie und Genetik] (BSc Biochemistry) or module Molecular Developmental Biology and Oncology [Molekulare Entwicklungsbiologie und Onkologie] (BSc Biochemistry).

Learning objectives Students who have successfully completed this module

• have profound knowledge about the regulation of polarized growth and asymmetric cell division including the required theoretical background.
• have knowledge of the required laboratory techniques to answer subject specific questions on the basis of experiments.
• are capable of self-sustained preparation of a subject based on scientific literature and oral presentation including discussion.

Syllabus This module covers the following subject-specific topics:
• Theoretical background covering the topics intracellular protein transport, protein secretion, cell division and the regulation of these events
• Hands-on application of genetic, cell biological and protein chemical techniques in the context of a current research project
• Oral presentation of the experimental results and preparation of a written report

• Molecular Cell Biology. Lodish et al. Freeman 2008
• Biochemistry. Voet & Voet Wiley VCH 2011 |

| Teaching and learning methods | • Molecular Cell Biology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Molecular Cell Biology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Laboratory Course Genetics [Großpraktikum Genetik] (laboratory course), 12 credit hours [SWS], 12 credit points [LP] |

| Workload | Attendance: 240 h
Private study: 300 h
Sum: 540 h |

| Assessment | The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration. |

| Grading procedure | The grade of the module will be the grade of the exam. |

<p>| Basis for | - |</p>
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## Protein Biochemistry

**Modules referring to Molecular Biosciences - Compulsory Electives**

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marcus Fändrich</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others</td>
</tr>
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</table>

**Allocation of study programmes**

- Biochemistry MSc, start of studies: winter semester, compulsory elective module;
- Biology MSc, start of studies: winter semester, compulsory elective module

**Recommended prerequisites**

- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

**Learning objectives**

- Students who have successfully completed this module
  - have a broad overview on the structural properties of proteins,
  - know relevant techniques to structurally investigate proteins,
  - have insight in the most important protein-folding diseases,
  - are trained in planning scientific experiments themselves,
  - are trained in giving a scientific talk.

**Syllabus**

- This module covers the following subject-specific topics:
  - Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
  - Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
- Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer's disease, Parkinson's disease, bovine spongiform encephalopathy (BSE), scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA, AL and ATTR amyloidosis, etc.

**Literature**
Will be announced in the courses

**Teaching and learning methods**
- Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Protein Biochemistry (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance time: 240 h
- Private study: 300 h
- Sum: 540 h

**Assessment**
- Attested report, ungraded. Successful participation in the seminar, ungraded.
- Written exam, graded.

**Grading procedure**
The grade is determined from the result of the exam.

**Basis for**
- Master thesis in protein biochemistry.
Advanced Neurobiology
Modules referring to Neurobiology

Code 8802670562

ECTS credits 21

Attendance time 18

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Harald Wolf

Instructor(s) Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf

Allocation of study programmes
• Biology MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended
• Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

Learning objectives Students who have successfully completed this module
• have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
• have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
• are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

Syllabus This module covers the following subject-specific topics:
Lectures:

- Energetics and allometry of animal movement
- Properties of ion channels and their contribution to neuronal excitation
- Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
- Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

- Experimental und theoretical treatment of the above mentioned topics (selected examples)

**Literature**

- Specific literature for laboratory course and seminar topics

**Teaching and learning methods**

- Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**


**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of behavioral biology or neurobiology
Tropical Conservation V - Universidad de Costa Rica
Modules referring to Neurobiology

Code 8802673912

ECTS credits 21

Attendance time 18

Language of instruction Spanish

Duration 1 Semester

Cycle each Summer Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Behavioral Physiology, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
## Tropical Botany V - Universidad de Costa Rica

Modules referring to Neurobiology

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### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Behavioral Physiology, Additional module

### Recommended prerequisites
see module description of the Universidad de Costa Rica.

### Learning objectives
see module description of the Universidad de Costa Rica.

### Syllabus
see module description of the Universidad de Costa Rica.

### Literature
see module description of the Universidad de Costa Rica.

### Teaching and learning methods
see module description of the Universidad de Costa Rica.

### Workload
see module description of the Universidad de Costa Rica.

### Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
Tropical Ecology V - Universidad de Costa Rica
Modules referring to Neurobiology

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Behavioral Physiology, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure  No english version available.

Basis for  -
## Tropical Zoology V - Universidad de Costa Rica

Modules referring to Neurobiology

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### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Behavioral Physiology, Additional module

### Recommended prerequisites

see module description of the Universidad de Costa Rica.

### Learning objectives

see module description of the Universidad de Costa Rica.

### Syllabus

see module description of the Universidad de Costa Rica.

### Literature

see module description of the Universidad de Costa Rica.

### Teaching and learning methods

see module description of the Universidad de Costa Rica.

### Workload

see module description of the Universidad de Costa Rica.

### Assessment

No english version available.
Grading procedure
No english version available.

Basis for
-
# Behavioral Physiology

Modules referring to Neurobiology

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<td>Prof. Dr. Harald Wolf</td>
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<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
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## Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended
- Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2\textsuperscript{nd} study semester

## Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

## Learning objectives
Students who have successfully completed this module
- know the elements and their function in neural control circuits, including efferent and behavioral control.
- have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
- are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
- have gained practical experience in handling laboratory animals.
- are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
- have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
This module covers the following subject-specific topics:

**Lecture Behavioral Physiology:**
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

**Lab course and seminar Behavioral Physiology:**
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

**Literature**
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

**Teaching and learning methods**
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the area of neurobiology or behavioral biology
### Basic Statistics for Biologists

**Modules referring to Biodiversity/Ecology**

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<tr>
<td></td>
<td>• have basic knowledge in statistics.</td>
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<tr>
<td></td>
<td>• are capable to operate the statistics package R, using the graphic user interface R commander.</td>
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<tr>
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<td>• know how to collect and organize data and perform data analysis.</td>
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<td>Syllabus</td>
<td>This module covers the following subject-specific topics:</td>
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<td>• Theoretical and practical knowledge on performing basic statistic tests (simple tests, multivariate statistics)</td>
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<td>• Exercises, using the software package R</td>
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<tr>
<td>Literature</td>
<td>• R script</td>
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<td>• Sachs, Angewandte Statistik (2002)</td>
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<td>• Sokal und Rohlf, Biometry (1981)</td>
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<td>Teaching and learning methods</td>
<td>• Statistics (lecture/exercise), 2 credit hours [SWS], 3 credit points [LP]</td>
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| Workload | Attendance time: 30 h  
Private study: 60 h  
Sum: 90 h |
| Assessment | Terminal written exam |
| Grading procedure | No grades; exam must be passed by >50% |
| Basis for | Modules in the special subject Biodiversity and Ecology |
Excursion
Modules referring to Biodiversity/Ecology

Code 8802670563

ECTS credits 3

Attendance time 3

Language of instruction English, German

Duration 1 Semester

Cycle each Summer Semester

Coordinator Dr. Philipp von Wrangell

Instructor(s) Lecturers from the faculty of biology

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.

Learning objectives Students who have successfully completed this module

- learned the characteristics of flora and fauna of exemplary ecosystems.
- have knowledge about ecological relations, interactions between organisms, interactions between organisms and their biotic and abiotic environment
- have knowledge about the human influence on ecosystems and their stability exemplified on natural or close to nature systems but also on typical cultural landscape systems.
- learned (depending on the excursions destination) methods of landscape management and environment protection.

Syllabus This module covers the following subject-specific topics:

- Knowledge of flora and fauna
- Understanding of ecosystematic relations
- Influence of humans on ecosystems
- Landscape management (where applicable)
- Methods of environment protection (where applicable)
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Tropical Conservation I - Universidad de Costa Rica - ungraded
Modules referring to Biodiversity/Ecology

Code 8802673916

ECTS credits 3

Attendance time 2

Language of instruction Spanish

Duration 1 Semester

Cycle each Winter Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Excursion, Basic Statistics for Biologists, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
**Tropical Botany I - Universidad de Costa Rica - ungraded**

Modules referring to Biodiversity/Ecology

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion, Basic Statistics for Biologists, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure  No english version available.

Basis for -
Tropical Ecology I - Universidad de Costa Rica - ungraded

Modules referring to Biodiversity/Ecology

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Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

  - Excursion
  - Basic Statistics for Biologists
  - Additional module

Recommended prerequisites
see module description of the Universidad de Costa Rica.

Learning objectives
see module description of the Universidad de Costa Rica.

Syllabus
see module description of the Universidad de Costa Rica.

Literature
see module description of the Universidad de Costa Rica.

Teaching and learning methods
see module description of the Universidad de Costa Rica.

Workload
see module description of the Universidad de Costa Rica.

Assessment
No english version available.
Grading procedure     No english version available.

Basis for

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### Tropical Zoology I - Universidad de Costa Rica - ungraded

Modules referring to Biodiversity/Ecology

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion
- Basic Statistics for Biologists
- Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

No english version available.
**Grading procedure**

No english version available.

**Basis for**

-
Advanced Systematics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802670565
ECTS credits 9
Attendance time 8
Language of instruction English
Duration 1 Semester
Cycle each Summer Semester
Coordinator Prof. Dr. Dieter Waloßek
Instructor(s) Dipl.Biol. Verena Kutschera, apl. Prof. Dr. Andreas Maas, Prof. Dr. Dieter Waloßek

Allocation of study programmes
Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives
Students who have successfully completed this module
• possess a deepened knowledge about Crustacea as an example of a species-rich and morphologically diverse taxon within the Arthropoda and Metazoa in general, about modern research approaches and methods, make use of modern thoughts about evolution and phylogeny.
• are capable to evaluate different theoretical explanatory models in the light of current research results on a specific animal taxon, which (a) represents the largest marine animal group with (b) sometimes extreme deviations from earlier ground patterns, is (c) known from more than half a Billion years old fossils and with since then diverging evolutionary lineages, but (d) is presented very mistakably in traditional teaching and text books.
• know about special scientific literature for own investigations, the development of small projects, writing of reports and about the application of different methods of and investigation and documentation to particular problems and animal material.

Syllabus This module covers the following subject-specific topics:
• External morphology of Crustacea and changes of ground-pattern conditions in the evolutionary lineage towards living representatives; specific focus is laid on the locomotory and feeding apparatus as important aspects in the life and evolution of animals. The two main taxa Entomostraca and Malacostraca are substantiated as monophyla.

• Examples of selected taxa to be investigated using various methods, including dissection, investigation and documentation, including scanning electron microscopy and modern light microscopy techniques. More aspects are the ontogeny (e.g., culture of developmental stages), material collection in the field and consideration of functional morphology.

• Theory and methods of phylogenetic systematics as a backbone and methodological approach to investigations of interrelationships of taxa.

**Literature**

• Storch, V. & Welsch, U.: Kükenthal – Zoologisches Praktikum. Elsevier Spektrum Akademischer Verlag
• Own course guide with additional information to the studied objects, advice for sectioning and terminologies
• Handouts with additional information on the morphology and phylogeny of the relevant taxa
• Script of the lecture "Funktionsmorphologie der Tiere" [in German] from bachelor study
• Relevant literature on Crustacea and special scientific papers

**Teaching and learning methods**

• Morphology, Systematics and Phylogeny of Crustacea (lecture), 2 credit hours [SWS], 3 credits points [LP]
• Morphology, Systematics and Phylogeny of Crustacea (laboratory course), 6 credit hours [SWS], 9 credit points [LP]

**Workload**

Attendance time: 120 h
Private study: 150 h
Sum: 270 h

**Assessment**

Ungraded protocol with drawings and other documentaries, photographs, SEM micrographs, etc. Graded oral examination (or, if necessary, written examination).

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in biodiversity / zoological systematics
Chemical Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802674168

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Manfred Ayasse

Instructor(s) Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomashko

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives Students who have successfully completed this module
- have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.
- can apply modern methods used in chemical ecology and behavioral ecology.
- have basic knowledge on the biology and ecology of social insects.

Syllabus This module covers the following subject-specific topics:

Lecture/seminar:
- Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (allomones), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.
- In-depth information about the biology of social insects.
- Oral presentation and summarization of relevant scientific papers.

Laboratory course:
• Experiments on behavioral ecology and sociobiology of insects.
• Application of important methods used in chemical ecology.
• Apart from the specific content, basic methods used in scientific writing are taught as well.

Literature
• Harborne JB: Ökologische Biochemie. Spektrum Verlag, neueste Auflage
• Further literature is presented during the course.

Teaching and learning methods
• Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
• Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 120 h
Private study: 150 h
Sum: 270 h

Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of chemical ecology
**Evolutionary Ecology: Interactions of Organisms**

Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for

No english version available yet.
## Conservation Genomics

*Modules referring to Biodiversity/Ecology - Compulsory Electives*

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<td>Prof. Dr. Simone Sommer</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie]. But also possible: Molecular Biology / Microbiology</td>
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<td><strong>Learning objectives</strong></td>
<td>Students who have successfully completed this module</td>
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<tr>
<td></td>
<td>• have basic knowledge about the principles and concepts of population and conservation genetics that influence genetic diversity and wildlife health</td>
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<td>• have a good overview on the methods currently used to assess genetic diversity, as well as their advantages and limitations</td>
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<td>• understand the functional importance of immune gene variability (MHC) in life history decisions (mate choice), evolutionary ecology (parasite and pathogen resistance) and conservation (population health)</td>
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<td></td>
<td>• have a good overview on what drives gut bacterial diversity (microbiome) as well as associated health effects in wildlife species</td>
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<td></td>
<td>• can apply selected modern methods used in evolutionary genetics and conservation genomics</td>
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<td></td>
<td>• are able to perform efficient data mining and are able to handle and process large amounts of genetic sequences</td>
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### Syllabus
Lecture/seminar:
• Concepts in population and conservation genetics
• In-depth information on various genetic markers used in population and conservation genetics and possible applications
• Next generation sequencing technologies: overview, chances and caveats
• Basic knowledge of sequence databases, genome repositories and other online resources of genetic data for evolutionary biologists
• Introduction of the most important genetic software packages for data analysis
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:
• Primer design in non-model organisms, i.e. wildlife species
• Molecular lab work: genetic data generation to measure genetic diversity in an evolutionary and conservation context
• Basics in bioinformatic data processing with a focus on MHC and microbiome data
• Application of genetic software packages for data analyses (e.g. BLAST, alignments and assembly tools, building phylogenetic trees)
• Apart from the specific content, basic methods used in scientific writing are taught as well.

Literature
• Further literature will be presented during the course

Teaching and learning methods
• Conservation Genomics (lecture), 4 credit hours [SWS], 4 credit points [LP]
• Conservation Genomics (seminar), 2 credit hours [SWS], 2 credit points [LP]
• Conservation Genomics (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 120 h
Private study: 150 h
Sum: 270 h

Assessment
No english version available yet.

Grading procedure
No english version available yet.

Basis for
Master thesis in the area of conservation genomics and EcoHealth.
### Tropical Conservation II - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Conservation IV - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

No english version available.
Grading procedure

No english version available.

Basis for

-
### Ecology of the Mediterranean
Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for

No english version available.
Ecology of Tropical Habitats
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802674170

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Steven Jansen

Instructor(s) Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme.

Contentually: Module Biodiversity and Ecology.

Learning objectives Students who have successfully completed this module

• have general knowledge about the ecology of tropical ecosystems.
• are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.
• know selected groups of organisms and interactions occurring in tropical ecosystems.
• have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.
• are capable to verify and analyze observations and experimental results and to present these orally and in writing.

Syllabus This module covers the following subject-specific topics:

Lecture:

• Basic introduction to tropical ecosystems, incl. basics of climatology
• Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains
• Overview on important taxa of tropical plants and animals
• Animal-plant interaction in the tropics
• Specific threats to tropical ecosystems

Seminar:
• Presentation and discussion of selected publications on tropical ecology

Laboratory course:
• Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
• Ecophysiology of tropical plants
• Behavioral ecology and social organization of tropical bats
• Application and development of techniques for measuring tropical diversity

Literature

Teaching and learning methods
• Tropical Ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 210 h
Private study: 330 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of ecology/biodiversity.
# Soil and Water

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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<td>Coordinator</td>
<td>Prof. Dr. Marian Kazda</td>
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**Instructor(s)**

Biology lecturers from following universities:

- Ulm University (Ulm, Germany)
- University of South Bohemia in Ceske Budejovice (Budweis, Czech Republic)
- Aix-Marseille University (Marseille, France)
- Estonian University of Life Sciences (Tartu, Estonia)

**Allocation of study programmes**

- Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) or 3\(^{rd}\) study semester
- Biology MSc, start of studies: winter semester, optional module, 1\(^{st}\) or 3\(^{rd}\) study semester
- Biology Teacher Training, compulsory elective module, 5\(^{th}\), 7\(^{th}\) or 9\(^{th}\) study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module

- have knowledge and competence regarding interactions between soils, plants and soil organisms with special emphasis on soil processes and effects of drought and flooding on plants and soil organisms.
- know the major risks of soil degradation.
- are familiar with the link between soil functions and societal needs and expectations.
Syllabus

This module covers the following subject-specific topics:

• Soil science
• Ecology
• Plant sciences
• Zoology

Literature

• Lectures notes and practical course notes
• Scientific articles for the seminars

Teaching and learning methods

• Lectures, 2 credit hours [SWS], 3 credit points [LP]
• Seminars, 1 credit hours [SWS], 2 credit points [LP]
• Practical courses / excursions, 3 credit hours [SWS], 4 credit points [LP]

Workload

Attendance: 90 h
Private study: 180 h
Sum: 270 h

Assessment

Oral exam

Grading procedure

The exam grade is the module grade.

Basis for

Master thesis in the area of ecology/biodiversity
# Field Ecology II

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>PD Dr. Marco Tschapka</td>
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<td>PD Dr. Marco Tschapka, Jun. Prof. Dr. Steven Jansen</td>
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## Allocation of study programmes
Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm

## Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

## Learning objectives
Students who have successfully completed this module

- have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
- have a broad overview on animals and plants in tropical rainforests.
- have first experience with field work in a tropical ecosystem.
- are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
- have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
- have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
- have obtained first experience with international scientific cooperation.

## Syllabus
This module covers the following subject-specific topics:
- Tropical ecology, focusing on Costa Rican ecosystems
- Overview and practical experience with plants and animals of Central American rain forests
- Introduction to field work in the tropics (group projects and individual projects)
- Basics of scientific work, including literature studies
- Experimental design, statistical testing of hypotheses, write-up of results
- Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

**Literature**


**Teaching and learning methods**

- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

<table>
<thead>
<tr>
<th>Attendance: 240 h</th>
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**Assessment**

- Oral presentation in the seminar, laboratory course reports, written exam

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
### Field Ecology III

Modules referring to Biodiversity/Ecology - Compulsory Electives

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### Tropical Ecology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for  -
### Tropical Zoology II - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**: The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**: see module description of the Universidad de Costa Rica.

**Learning objectives**: see module description of the Universidad de Costa Rica.

**Syllabus**

**Literature**

**Teaching and learning methods**

**Workload**

**Assessment** No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Zoology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

**Recommended prerequisites**

see module description of the Universidad de Costa Rica.

**Learning objectives**

see module description of the Universidad de Costa Rica.

**Syllabus**

see module description of the Universidad de Costa Rica.

**Literature**

see module description of the Universidad de Costa Rica.

**Teaching and learning methods**

see module description of the Universidad de Costa Rica.

**Workload**

see module description of the Universidad de Costa Rica.

**Assessment**

No english version available.
**Grading procedure**  No english version available.

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**Wetland Ecology**

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marian Kazda</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Jan Dickopp, Ph.D. Ing. Tomás Picek (primarily responsible), Dr. Martin Werth</td>
</tr>
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**Allocation of study programmes**
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester;
- Biology BSc, start of studies: winter semester, optional module, 1st, 3rd or 5th study semester;
- Biology Teacher Training, start of studies: winter semester, compulsory elective module, 1st, 3rd, 5th, 7th or 9th study semester

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Module Ecology [Ökologie], 2nd study semester BSc.

**Learning objectives**
- Students who have successfully completed this module
  - possess general knowledge about wetland ecology.
  - know concepts for anthropogenic use of wetlands.
  - conducted student projects concerning wetland ecology from concept to report.
  - have the ability to critically evaluate and present observations and experimental results.
  - can prepare relevant literature for a time-limited talk.

**Syllabus**
- This module covers the following subject-specific topics:
  - Lecture:
• General introduction to various wetland ecosystems
• Types of wetlands
• Hydrology and soils
• Adaptations of plants
• Biogeochemistry
• Moors, tropical wetlands, coast wetlands
• Anthropogenic use: Use and destruction of moors, rice fields, constructed wetlands
• Protection, renaturation and management of wetlands

Seminar:
• Presentation and discussion of selected publications from the topic area of wetland ecology

Laboratory course and excursions:
• Basics of scientific working, incl. literature search, data acquisition, statistical analysis, report writing
• Ecophysiology of wetland plants (gas exchange, nutrient balance)
• Anatomy of wetland plants (aerenchyma, hyaline cells, …)
• Gas transport by wetland plants
• Capture of chemical parameters in soil and water

Literature

Teaching and learning methods
• Wetland ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Wetland ecology (seminar), 2 credit hours [SWS], 2+1 credit points [LP]
• Wetland ecology (laboratory course + excursion), 3 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 105 h
Private study: 165 h
Sum: 270 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Further courses in the area of ecology / ecosystem dynamics, theses in the Institute for Systematic Botany and Ecology
### Patent Law

**Modules referring to Molecular Biosciences**

**Code** 8802670555

**ECTS credits** 3

**Attendance time** 1

**Language of instruction** German

**Duration** 1 Semester

**Cycle** each Winter Semester

**Coordinator** Dean of studies (chemistry department)

**Instructor(s)** Dr. Helmut Reitzle

**Allocation of study programmes**
- Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester;
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: None.

**Learning objectives**
- Students who have successfully completed this module
  - have knowledge about the fundamentals of the patent system.

**Syllabus**
- This module covers the following subject-specific topics:
  - Part 1: Rights of use, exhaustion of rights of use using powers, mediate patent infringement, right of prior use, restriction of the effect of the patent, extend of protection, infringement of the protective right, the rights to the invention.
  - Part 2: Novelty, the inventive step, industrial application.
  - Part 3: procedural law, general rules, representation, patent application, procedure up to granting, eliminations of patents, objection, nullity.

**Literature**
- Literature will be provided in the lecture
<table>
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<tr>
<th><strong>Teaching and learning methods</strong></th>
<th>• Patent Right for Natural Scientists [Patentrecht für Naturwissenschaftler] (lecture), 1 credit hour [SWS], 3 credit points [LP]</th>
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<td><strong>Assessment</strong></td>
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<tr>
<td><strong>Grading procedure</strong></td>
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Medical Products
Modules referring to Molecular Biosciences

Code 8802671712

ECTS credits 3

Attendance time 1

Language of instruction German

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Peter Gierschik

Instructor(s) Dr. Thomas Bräuner, Dr. Dieter Eckhardt, Dr. Karl Heinz Emmert, Dr. Armin Frey, Prof. Dr. Peter Gierschik, Dr. Udo Hartlaub, Dr. Thomas Kammermeier, Dr. Thomas Lamprecht, Dr. Eberhardt Landsbeck, Dr. Rainer Winstel

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester;

Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: No information.

Learning objectives Students who have successfully completed this module

• have knowledge about drug development in general, as well as on the level of chemistry/pharmaceutics and pharmacology/toxicology in special, under consideration of corresponding legal rules and standards.
• know the legal requirements for first clinical application of new pharmaceuticals.
• have a clear idea how clinical studies are designed and they know how to interpret and assess corresponding data.
• have knowledge about safety and regulation of pharmaceutical products.

Syllabus This module covers the following subject-specific topics:

• Introduction, history of drug development, procedure outline of a drug development, rules and standards
• Chemical/pharmaceutical development I: Development of active pharmaceutical ingredients
• Chemical/pharmaceutical development II: Development of final products
• Pharmacological/toxicological development I: From drug discovery and pre-clinical development to first application on human beings
• Pharmacological/toxicological development II: Toxicology and safety issues of pharmacology
• Pharmacological/toxicological development III: Pharmacokinetics and metabolism
• Clinical development: From first application on human beings to proof of efficiency and safety
• Planning and execution of rules and standards
• Pharmaceutical product information and labeling
• Safety of pharmaceutical products: Basics
• Safety of pharmaceutical products: Structure and risk management
• Biopharmaceutical drugs: Development, production and control
• Generic medicaments: Quality, substitution
• Regulation of pharmaceutical products in Germany
• Regulation of pharmaceutical products in the European Union

**Literature**

*No information*

**Teaching and learning methods**

• W 68 Development, Regulation and Monitoring of Medical Products [W 68 Entwicklung, Zulassung und Überwachung von Arzneimitteln] (seminar), 1 credit hour [SWS], 3 credit points [LP]

**Workload**

- Attendance: 15 h
- Private study: 75 h
- Sum: 90 h

**Assessment**

Evidence of course achievement

**Grading procedure**

The module is not graded.

**Basis for**

-
Quality Control
Modules referring to Molecular Biosciences

Code 8802670556

ECTS credits 3

Attendance time 2

Language of instruction German

Duration 1 Semester

Cycle each Summer Semester

Coordinator Dr. Frank Rosenau

Instructor(s) Dr. Frank Rosenau, Dr. Frank Bengelsdorf

Allocation of study programmes

Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lectures (basic laboratory courses, respectively) in microbiology, biochemistry, chemistry, pharmacy.

Learning objectives

Students who have successfully completed this module

• possess fundamental knowledge about installation and operation of pharmaceutical productions processes in the scope of legal regulations.
• are qualified to understand pharmaceutical production by real practical examples.
• achieve a theoretical preparation to an important potential occupational area.

Syllabus

This module covers the following subject-specific topics:

• Quality assurance and sterilization/validation of medical devices
• Development, production and pharmaceutical formulation of therapeutic glycoproteins
• Bioanalytical methods under GLP conditions
• Hygienic design of pharmaceutical production facilities
• Chemical quality controls of active agents and additives
• Rules and standards, inspection authorities: GMP and GLP
• Microbiology in the pharmaceutical industry
• New technologies and strategies for analysis of pharmaceutics
• Biotechnological production of biosimilars
• Design of production facilities at various culture techniques and production organisms

<table>
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<tr>
<th>Literature</th>
<th>PowerPoint slides from the presentations of the lecturers (incl. cited sources) will be sent to the participants via an email list.</th>
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| Workload            | Attendance: 30 h  
                      Private study: 60 h  
                      Sum: 90 h                                                        |
| Assessment          | Attendance as evidence of course achievement                                                                               |
| Grading procedure   | The module is not graded.                                                                                                 |
| Basis for           | -                                                                                                                         |
## Microbiology - Master

Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel</td>
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### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 2\textsuperscript{nd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 2\textsuperscript{nd} study semester recommended

### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).

### Learning objectives
- Students who have successfully completed this module
  - have extended knowledge on key topics in microbiology and molecular microbiology.
  - have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.
  - have gathered experience in actively discussing scientific presentations
  - have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.
  - are able to individually work under supervision on own topics related to current research.
Syllabus

This module covers the following subject-specific topics:

Lectures:

- **Microbiology IV** (Microbial Regulation):
  - RNA: Structure and function: (Ribosomal RNA (rRNA); Transfer RNA (tRNA); Messenger RNA (mRNA); Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  - Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  - Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  - Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction (negative control); Induction (positive control); Repression (negative control); Repression (positive control); cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition!); Attenuation in *Escherichia coli* (amino acid biosynthesis); Attenuation (antibiotic resistance induction); Attenuation (pyrimidine biosynthesis); Attenuation in *Bacillus subtilis* (amino acid biosynthesis); Autogenic control; 2-Component systems (*arc, ntr, che*); FNR-dependent regulation; Sigma factor-dependent regulation (heat shock, nitrogen metabolism, sporulation); T-box-dependent regulation; Regulation by modification of tRNA bases; antisenseRNA-dependent regulation (plasmid replication, osmoregulation); Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing (*Vibrio harveyi, Staphylococcus aureus*); Regulation by rarely used tRNAs; Stringent response; Signal molecules)
  - Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)
- **Host-Microbe Interactions:**
  - Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

- **Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense**

Laboratory course (Microbiology Advanced Course):

- **Principles and methods of enrichment, isolation and characterization of microorganisms** (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogens; serological and enzymatic analysis of β-galactosidase in *Escherichia coli*; isolation and analysis of genes from *Acinetobacter* sp. and cloning of these genes; cultivation of *Ashbya gossypii* and analysis of substrate consumption and riboflavin formation by a mutant of this fungus; characterization of a key enzyme of riboflavin synthesis; growth, substrate consumption and glutamate production of *Corynebacterium glutamicum*; analysis of key enzymes of glutamate synthesis
- **Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrecht); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment**
Literature


Teaching and learning methods

- Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester
- Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester
- Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

Workload

Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment

Audited protocol, not graded; Successful participation at the seminar; not graded.
Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

Grading procedure

The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

Basis for

Master thesis in the Institute of Microbiology and Biotechnology
## Molecular Botany

Modules referring to Molecular Biosciences - Compulsory Electives

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<tr>
<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>apl. Prof. Dr. Stefan Binder</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka</td>
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</table>

### Allocation of study programmes

- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).

### Learning objectives

Students who have successfully completed this module

- have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.
- are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.
- are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.
- have expertise to judge and deliberate benefits and risks in green gene technology.

### Syllabus

This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

Literature
• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition

Teaching and learning methods
• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]
• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of molecular botany
# Endocrinology

Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Jan Tuckermann</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Röszer, Dr. Sabine Vettorazzi</td>
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**Allocation of study programmes**
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Bioscience [Molekulare Biowissenschaften].

**Learning objectives**
Students who have successfully completed this module
- possess advanced knowledge about key issues in endocrinology and molecular endocrinology.
- have the ability for self-dependent preparation of a topic by original papers and to present it in a talk.
- are qualified for advanced practical work in a current research project in the area of molecular endocrinology.

**Syllabus**
This module covers the following subject-specific topics:
- Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue.
• Practice of working techniques in cell biology, protein chemistry and molecular biology.
• Summarizations of results in a work record respectively a poster as well as an oral presentation.

**Literature**
- Current textbooks about biochemistry as well as physiology

**Teaching and learning methods**
- Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance: 240 h
- Private study: 300 h
- Sum: 540 h

**Assessment**
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the Institute of Comparative Molecular Endocrinology
### Genetics
Modules referring to Molecular Biosciences - Compulsory Electives

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<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Nils Johnsson</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Alexander Dünkler, Dr. Thomas Gronemeyer, Prof. Dr. Nils Johnsson</td>
</tr>
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</table>

**Allocation of study programmes**

- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in genetics and cell biology; e.g. module Developmental Biology and Genetics [Entwicklungsbiologie und Genetik] (BSc Biology), module Microbiology and Genetics [Mikrobiologie und Genetik] (BSc Biochemistry) or module Molecular Developmental Biology and Oncology [Molekulare Entwicklungsbiologie und Onkologie] (BSc Biochemistry).

**Learning objectives**

Students who have successfully completed this module

- have profound knowledge about the regulation of polarized growth and asymmetric cell division including the required theoretical background.
- have knowledge of the required laboratory techniques to answer subject specific questions on the basis of experiments.
- are capable of self-sustained preparation of a subject based on scientific literature and oral presentation including discussion.

**Syllabus**

This module covers the following subject-specific topics:
- Theoretical background covering the topics intracellular protein transport, protein secretion, cell division and the regulation of these events
- Hands-on application of genetic, cell biological and protein chemical techniques in the context of a current research project
- Oral presentation of the experimental results and preparation of a written report

<table>
<thead>
<tr>
<th>Literature</th>
</tr>
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</table>
| Molecular Cell Biology. Lodish et al. Freeman 2008  
| Biochemistry. Voet & Voet Wiley VCH 2011 |

<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
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</table>
| Molecular Cell Biology (lecture), 2 credit hours [SWS], 3 credit points [LP]  
| Molecular Cell Biology (seminar), 2 credit hours [SWS], 3 credit points [LP]  
| Laboratory Course Genetics [Großpraktikum Genetik] (laboratory course), 12 credit hours [SWS], 12 credit points [LP] |

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<th>Workload</th>
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| Attendance: 240 h  
| Private study: 300 h  
| Sum: 540 h |

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Master of Science Biology  Date printed: 14. Dezember 2017  page 106 of 482
## Conservation Genomics and Molecular Biology

Modules referring to Molecular Biosciences - Compulsory Electives

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# Protein Biochemistry

**Modules referring to Molecular Biosciences - Compulsory Electives**

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<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marcus Fändrich</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others</td>
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</table>

**Allocation of study programmes**

Biochemistry MSc, start of studies: winter semester, compulsory elective module; Biology MSc, start of studies: winter semester, compulsory elective module

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

**Learning objectives**

Students who have successfully completed this module

- have a broad overview on the structural properties of proteins,
- know relevant techniques to structurally investigate proteins,
- have insight in the most important protein-folding diseases,
- are trained in planning scientific experiments themselves,
- are trained in giving a scientific talk.

**Syllabus**

This module covers the following subject-specific topics:

- Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
- Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer's disease, Parkinson's disease, bovine spongiform encephalopathy (BSE), scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA, AL and ATTR amyloidosis, etc.

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<tr>
<td>Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]</td>
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<td>Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<td><strong>Assessment</strong></td>
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<td><strong>Basis for</strong></td>
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# Advanced Neurobiology

Modules referring to Neurobiology - Compulsory Electives

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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
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</table>

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) or 3\(^{rd}\) study semester recommended
- Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) study semester

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives

Students who have successfully completed this module

- have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
- have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
- are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

### Syllabus

This module covers the following subject-specific topics:
Lectures:

- Energetics and allometry of animal movement
- Properties of ion channels and their contribution to neuronal excitation
- Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
- Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

- Experimental und theoretical treatment of the above mentioned topics (selected examples)

<table>
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<th>Literature</th>
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<td>Specific literature for laboratory course and seminar topics</td>
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<tr>
<td>Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]</td>
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<td>Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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## Behavioral Physiology

Modules referring to Neurobiology - Compulsory Electives

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<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Harald Wolf</td>
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<tr>
<td><strong>Instructor(s)</strong></td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended
- Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2nd study semester

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives
Students who have successfully completed this module

- know the elements and their function in neural control circuits, including efferent and behavioral control.
- have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
- are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
- have gained practical experience in handling laboratory animals.
- are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
- have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
This module covers the following subject-specific topics:

Lecture Behavioral Physiology:
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

Lab course and seminar Behavioral Physiology:
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

Literature
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

Teaching and learning methods
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

Workload
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

Assessment
- The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
- The grade of the module will be the grade of the exam.

Basis for
- Master thesis in the area of neurobiology or behavioral biology
**Patent Law**  
Modules referring to Molecular Biosciences

**Code**  
8802670555

**ECTS credits**  
3

**Attendance time**  
1

**Language of instruction**  
German

**Duration**  
1 Semester

**Cycle**  
each Winter Semester

**Coordinator**  
Dean of studies (chemistry department)

**Instructor(s)**  
Dr. Helmut Reitzle

**Allocation of study programmes**  
Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester;

Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester

**Recommended prerequisites**  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: None.

**Learning objectives**  
Students who have successfully completed this module

• have knowledge about the fundamentals of the patent system.

**Syllabus**  
This module covers the following subject-specific topics:

• Part 1: Rights of use, exhaustion of rights of use using powers, mediate patent infringement, right of prior use, restriction of the effect of the patent, extend of protection, infringement of the protective right, the rights to the invention.

• Part 2: Novelty, the inventive step, industrial application.

• Part 3: procedural law, general rules, representation, patent application, procedure up to granting, eliminations of patents, objection, nullity.

**Literature**  
Literature will be provided in the lecture
<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>• Patent Right for Natural Scientists [Patentrecht für Naturwissenschaftler] (lecture), 1 credit hour [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>
| Workload                     | Attendance: 15 h  
Private study: 75 h  
Sum: 90 h |
| Assessment                   | Compulsory attendance, absence on maximally one appointment is tolerated (except excursion) |
| Grading procedure            | The module is not graded. |
| Basis for                    | - |
Medical Products
Modules referring to Molecular Biosciences

**Code** 8802671712

**ECTS credits** 3

**Attendance time** 1

**Language of instruction** German

**Duration** 1 Semester

**Cycle** each Winter Semester

**Coordinator** Prof. Dr. Peter Gierschik

**Instructor(s)** Dr. Thomas Bräuner, Dr. Dieter Eckhardt, Dr. Karl Heinz Emmert, Dr. Armin Frey, Prof. Dr. Peter Gierschik, Dr. Udo Hartlaub, Dr. Thomas Kammermeier, Dr. Thomas Lamprecht, Dr. Eberhardt Landsbeck, Dr. Rainer Winstel

**Allocation of study programmes** Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester;

Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester

**Recommended prerequisites** Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: *No information.*

**Learning objectives** Students who have successfully completed this module

- have knowledge about drug development in general, as well as on the level of chemistry/pharmaceutics and pharmacology/toxicology in special, under consideration of corresponding legal rules and standards.
- know the legal requirements for first clinical application of new pharmaceuticals.
- have a clear idea how clinical studies are designed and they know how to interpret and assess corresponding data.
- have knowledge about safety and regulation of pharmaceutical products.

**Syllabus** This module covers the following subject-specific topics:

- Introduction, history of drug development, procedure outline of a drug development, rules and standards
• Chemical/pharmaceutical development I: Development of active pharmaceutical ingredients
• Chemical/pharmaceutical development II: Development of final products
• Pharmacological/toxicological development I: From drug discovery and pre-clinical development to first application on human beings
• Pharmacological/toxicological development II: Toxicology and safety issues of pharmacology
• Pharmacological/toxicological development III: Pharmacokinetics and metabolism
• Clinical development: From first application on human beings to proof of efficiency and safety
• Planning and execution of rules and standards
• Pharmaceutical product information and labeling
• Safety of pharmaceutical products: Basics
• Safety of pharmaceutical products: Structure and risk management
• Biopharmaceutical drugs: Development, production and control
• Generic medicaments: Quality, substitution
• Regulation of pharmaceutical products in Germany
• Regulation of pharmaceutical products in the European Union

**Literature**

- No information

**Teaching and learning methods**

- W 68 Development, Regulation and Monitoring of Medical Products [W 68 Entwicklung, Zulassung und Überwachung von Arzneimitteln] (seminar), 1 credit hour [SWS], 3 credit points [LP]

**Workload**

- Attendance: 15 h
- Private study: 75 h
- Sum: 90 h

**Assessment**

- Evidence of course achievement

**Grading procedure**

- The module is not graded.

**Basis for**

-
Quality Control
Modules referring to Molecular Biosciences

Code 8802670556

ECTS credits 3

Attendance time 2

Language of instruction German

Duration 1 Semester

Cycle each Summer Semester

Coordinator Dr. Frank Rosenau

Instructor(s) Dr. Frank Rosenau, Dr. Frank Bengelsdorf

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lectures (basic laboratory courses, respectively) in microbiology, biochemistry, chemistry, pharmacy.

Learning objectives Students who have successfully completed this module

• possess fundamental knowledge about installation and operation of pharmaceutical productions processes in the scope of legal regulations.
• are qualified to understand pharmaceutical production by real practical examples.
• achieve a theoretical preparation to an important potential occupational area.

Syllabus This module covers the following subject-specific topics:

• Quality assurance and sterilization/validation of medical devices
• Development, production and pharmaceutical formulation of therapeutic glycoproteins
• Bioanalytical methods under GLP conditions
• Hygienic design of pharmaceutical production facilities
- Chemical quality controls of active agents and additives
- Rules and standards, inspection authorities: GMP and GLP
- Microbiology in the pharmaceutical industry
- New technologies and strategies for analysis of pharmaceutics
- Biotechnological production of biosimilars
- Design of production facilities at various culture techniques and production organisms

**Literature**

PowerPoint slides from the presentations of the lecturers (incl. cited sources) will be sent to the participants via an email list.

**Teaching and learning methods**

Quality Management [Qualitätssicherung] (lecture), 2 credit hours [SWS], 3 credit points [LP]

**Workload**

- Attendance: 30 h
- Private study: 60 h
- Sum: 90 h

**Assessment**

Attendance as evidence of course achievement

**Grading procedure**

The module is not graded.

**Basis for**

-
Microbiology - Master
Modules referring to Molecular Biosciences - Compulsory Electives

Code 8802670557
ECTS credits 18
Attendance time 17
Language of instruction English, German
Duration 2 Semester
Cycle each Winter Semester
Coordinator Prof. Dr. Bernhard Eikmanns
Instructor(s) Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel

Allocation of study programmes
Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended;
Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).

Learning objectives Students who have successfully completed this module
• have extended knowledge on key topics in microbiology and molecular microbiology.
• have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.
• have gathered experience in actively discussing scientific presentations
• have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.
• are able to individually work under supervision on own topics related to current research.
This module covers the following subject-specific topics:

Lectures:

• Microbiology IV (Microbial Regulation):
  RNA: Structure and function: (Ribosomal RNA [rRNA]; Transfer RNA [tRNA]; Messenger RNA [mRNA]; Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction [negative control]; Induction [positive control]; Repression [negative control]; Repression [positive control]; cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition?); Attenuation in Escherichia coli [amino acid biosynthesis]; Attenuation [antibiotic resistance induction]; Attenuation [pyrimidine biosynthesis]; Attenuation in Bacillus subtilis [amino acid biosynthesis]; Autogenenic control; 2-Component systems {arc, ntr, che}; FNR-dependent regulation; Sigma factor-dependent regulation [heat shock, nitrogen metabolism, sporulation]; T-box-dependent regulation; Regulation by modification of tRNA bases; AntisenseRNA-dependent regulation [plasmid replication, osmoregulation]; Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing {Vibrio harveyi, Staphylococcus aureus}; Regulation by rarely used tRNAs; Stringent response; Signal molecules)
  Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)

• Host-Microbe Interactions:
  Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

• Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense

Laboratory course (Microbiology Advanced Course):

• Principles and methods of enrichment, isolation and characterization of microorganisms (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogens; serological and enzymatic analysis of β-galactosidase in Escherichia coli; isolation and analysis of genes from Acinetobacter sp. and cloning of these genes; cultivation of Ashbya gossypii and analysis of substrate consumption and riboflavin formation by a mutant of this fungus; characterization of a key enzyme of riboflavin synthesis; growth, substrate consumption and glutamate production of Corynebacterium glutamicum; analysis of key enzymes of glutamate synthesis
• Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrecht); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment
Literature


Teaching and learning methods

- Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester
- Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester
- Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

Workload

Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment

Audited protocol, not graded; Successful participation at the seminar; not graded.

Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

Grading procedure

The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

Basis for

Master thesis in the Institute of Microbiology and Biotechnology
Molecular Botany
Modules referring to Molecular Biosciences - Compulsory Electives

Code 8802670558

ECTS credits 18

Attendance time 17

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator apl. Prof. Dr. Stefan Binder

Instructor(s) apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).

Learning objectives Students who have successfully completed this module

• have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.
• are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.
• are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.
• have expertise to judge and deliberate benefits and risks in green gene technology.

Syllabus This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

**Literature**

• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition

**Teaching and learning methods**

• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]
• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]

**Workload**

Attendance: 255 h
Private study: 285 h
Sum: 540 h

**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the area of molecular botany
## Endocrinology

Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Jan Tuckermann</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Röszer, Dr. Sabine Vettorazzi</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Bioscience [Molekulare Biowissenschaften].

### Learning objectives
Students who have successfully completed this module
- possess advanced knowledge about key issues in endocrinology and molecular endocrinology.
- have the ability for self-dependent preparation of a topic by original papers and to present it in a talk.
- are qualified for advanced practical work in a current research project in the area of molecular endocrinology.

### Syllabus
This module covers the following subject-specific topics:
- Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue.
- Practice of working techniques in cell biology, protein chemistry and molecular biology.
- Summarizations of results in a work record respectively a poster as well as an oral presentation.

### Literature
- Current textbooks about biochemistry as well as physiology

### Teaching and learning methods
- Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

### Workload
- Attendance: 240 h
- Private study: 300 h
- Sum: 540 h

### Assessment
- The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

### Grading procedure
- The grade of the module will be the grade of the exam.

### Basis for
- Master thesis in the Institute of Comparative Molecular Endocrinology
### Genetics
Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Duration</td>
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</tr>
<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Nils Johnsson</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Alexander Dünkler, Dr. Thomas Gronemeyer, Prof. Dr. Nils Johnsson</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended;  
- Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Basic knowledge in genetics and cell biology; e.g. module Developmental Biology and Genetics [Entwicklungsbiologie und Genetik] (BSc Biology), module Microbiology and Genetics [Mikrobiologie und Genetik] (BSc Biochemistry) or module Molecular Developmental Biology and Oncology [Molekulare Entwicklungsbiologie und Onkologie] (BSc Biochemistry).

### Learning objectives
Students who have successfully completed this module  
- have profound knowledge about the regulation of polarized growth and asymmetric cell division including the required theoretical background.  
- have knowledge of the required laboratory techniques to answer subject specific questions on the basis of experiments.  
- are capable of self-sustained preparation of a subject based on scientific literature and oral presentation including discussion.

### Syllabus
This module covers the following subject-specific topics:
• Theoretical background covering the topics intracellular protein transport, protein secretion, cell division and the regulation of these events
• Hands-on application of genetic, cell biological and protein chemical techniques in the context of a current research project
• Oral presentation of the experimental results and preparation of a written report

Literature

• Molecular Cell Biology. Lodish et al. Freeman 2008
• Biochemistry. Voet & Voet Wiley VCH 2011

Teaching and learning methods

• Molecular Cell Biology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Molecular Cell Biology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Laboratory Course Genetics [Großpraktikum Genetik] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload

Attendance: 240 h
Private study: 300 h
Sum: 540 h

Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.

Basis for

-
## Conservation Genomics and Molecular Biology

Modules referring to Molecular Biosciences - Compulsory Electives

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## Protein Biochemistry
Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Cycle</td>
<td>each Summer Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marcus Fändrich</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module
- Biology MSc, start of studies: winter semester, compulsory elective module

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

### Learning objectives
Students who have successfully completed this module
- have a broad overview on the structural properties of proteins,
- know relevant techniques to structurally investigate proteins,
- have insight in the most important protein-folding diseases,
- are trained in planning scientific experiments themselves,
- are trained in giving a scientific talk.

### Syllabus
This module covers the following subject-specific topics:
- Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
- Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer's disease, Parkinson's disease, bovine spongiform encephalopathy (BSE), scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA, AL and ATTR amyloidosis, etc.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Will be announced in the courses</th>
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<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]</th>
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<tr>
<td></td>
<td>Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<td></td>
<td>Protein Biochemistry (laboratory course), 12 credit hours [SWS], 12 credit points [LP]</td>
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<th>Workload</th>
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<table>
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<tr>
<th>Assessment</th>
<th>Attested report, ungraded. Successful participation in the seminar, ungraded. Written exam, graded.</th>
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<table>
<thead>
<tr>
<th>Grading procedure</th>
<th>The grade is determined from the result of the exam.</th>
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</table>

| Basis for | Master thesis in protein biochemistry. |
Advanced Systematics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code: 8802670565
ECTS credits: 9
Attendance time: 8
Language of instruction: English
Duration: 1 Semester
Cycle: each Summer Semester
Coordinator: Prof. Dr. Dieter Waloßek
Instructor(s): Dipl. Biol. Verena Kutschera, apl. Prof. Dr. Andreas Maas, Prof. Dr. Dieter Waloßek

Allocation of study programmes: Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

Recommended prerequisites: Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives: Students who have successfully completed this module
- possess a deepened knowledge about Crustacea as an example of a species-rich and morphologically diverse taxon within the Arthropoda and Metazoa in general, about modern research approaches and methods, make use of modern thoughts about evolution and phylogeny.
- are capable to evaluate different theoretical explanatory models in the light of current research results on a specific animal taxon, which (a) represents the largest marine animal group with (b) sometimes extreme deviations from earlier ground patterns, is (c) known from more than half a Billion years old fossils and with since then diverging evolutionary lineages, but (d) is presented very mistakenly in traditional teaching and text books.
- know about special scientific literature for own investigations, the development of small projects, writing of reports and about the application of different methods of and investigation and documentation to particular problems and animal material.

Syllabus: This module covers the following subject-specific topics:
• External morphology of Crustacea and changes of ground-pattern conditions in the evolutionary lineage towards living representatives; specific focus is laid on the locomotory and feeding apparatus as important aspects in the life and evolution of animals. The two main taxa Entomostraca and Malacostraca are substantiated as monophyla.
• Examples of selected taxa to be investigated using various methods, including dissection, investigation and documentation, including scanning electron microscopy and modern light microscopy techniques. More aspects are the ontogeny (e.g., culture of developmental stages), material collection in the field and consideration of functional morphology.
• Theory and methods of phylogenetic systematics as a backbone and methodological approach to investigations of interrelationships of taxa.

**Literature**

• Storch, V. & Welsch, U.: Kükenthal – Zoologisches Praktikum. Elsevier Spektrum Akademischer Verlag
• Own course guide with additional information to the studied objects, advice for sectioning and terminologies
• Handouts with additional information on the morphology and phylogeny of the relevant taxa
• Script of the lecture "Funktionsmorphologie der Tiere" [in German] from bachelor study
• Relevant literature on Crustacea and special scientific papers

**Teaching and learning methods**

• Morphology, Systematics and Phylogeny of Crustacea (lecture), 2 credit hours [SWS], 3 credits points [LP]
• Morphology, Systematics and Phylogeny of Crustacea (laboratory course), 6 credit hours [SWS], 9 credit points [LP]

**Workload**

Attendance time: 120 h
Private study: 150 h
Sum: 270 h

**Assessment**

Ungraded protocol with drawings and other documentaries, photographs, SEM micrographs, etc. Graded oral examination (or, if necessary, written examination).

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in biodiversity / zoological systematics
**Chemical Ecology**  
Modules referring to Biodiversity/Ecology - Compulsory Electives

<table>
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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Manfred Ayasse</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomashko</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester</td>
</tr>
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**Recommended prerequisites**  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

**Learning objectives**  
Students who have successfully completed this module  
- have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.  
- can apply modern methods used in chemical ecology and behavioral ecology.  
- have basic knowledge on the biology and ecology of social insects.

**Syllabus**  
This module covers the following subject-specific topics:  

Lecture/seminar:  
- Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (allomones), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.  
- In-depth information about the biology of social insects.  
- Oral presentation and summarization of relevant scientific papers.

Laboratory course:
• Experiments on behavioral ecology and sociobiology of insects.
• Application of important methods used in chemical ecology.
• Apart from the specific content, basic methods used in scientific writing are taught as well.

### Literature

- Harborne JB: Ökologische Biochemie. Spektrum Verlag, neueste Auflage
- Further literature is presented during the course.

### Teaching and learning methods

- Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
- Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

### Workload

- Attendance: 120 h
- Private study: 150 h
- Sum: 270 h

### Assessment

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

### Grading procedure

The grade of the module will be the grade of the exam.

### Basis for

Master thesis in the area of chemical ecology
Evolutionary Ecology: Interactions of Organisms
Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for

No english version available yet.
Conservation Genomics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673045

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Simone Sommer

Instructor(s) Prof. Dr. Simone Sommer, Dr. Pablo Santos, Dr. Sebastian Menke

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie]. But also possible: Molecular Biology / Microbiology

Learning objectives Students who have successfully completed this module

• have basic knowledge about the principles and concepts of population and conservation genetics that influence genetic diversity and wildlife health
• have a good overview on the methods currently used to assess genetic diversity, as well as their advantages and limitations
• understand the functional importance of immune gene variability (MHC) in life history decisions (mate choice), evolutionary ecology (parasite and pathogen resistance) and conservation (population health)
• have a good overview on what drives gut bacterial diversity (microbiome) as well as associated health effects in wildlife species
• can apply selected modern methods used in evolutionary genetics and conservation genomics
• are able to perform efficient data mining and are able to handle and process large amounts of genetic sequences

Syllabus Lecture/seminar:
• Concepts in population and conservation genetics
• In-depth information on various genetic markers used in population and conservation genetics and possible applications
• Next generation sequencing technologies: overview, chances and caveats
• Basic knowledge of sequence databases, genome repositories and other online resources of genetic data for evolutionary biologists
• Introduction of the most important genetic software packages for data analysis
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:

• Primer design in non-model organisms, i.e. wildlife species
• Molecular lab work: genetic data generation to measure genetic diversity in an evolutionary and conservation context
• Basics in bioinformatic data processing with a focus on MHC and microbiome data
• Application of genetic software packages for data analyses (e.g. BLAST, alignments and assembly tools, building phylogenetic trees)
• Apart from the specific content, basic methods used in scientific writing are taught as well.

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Tropical Conservation II - Universidad de Costa Rica  
Modules referring to Biodiversity/Ecology - Compulsory Electives

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<tr>
<td><strong>Coordinator</strong></td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Instructors of the Universidad de Costa Rica</td>
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**Allocation of study programmes**  
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**  
see module description of the Universidad de Costa Rica.

**Learning objectives**  
see module description of the Universidad de Costa Rica.

**Syllabus**  
see module description of the Universidad de Costa Rica.

**Literature**  
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**  
see module description of the Universidad de Costa Rica.

**Workload**  
see module description of the Universidad de Costa Rica.

**Assessment**  
No english version available.
Grading procedure  No english version available.

Basis for  -
Tropical Conservation IV - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Cycle</td>
<td>Summer Semester every two Years</td>
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<td>Instructor(s)</td>
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### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

### Recommended prerequisites
see module description of the Universidad de Costa Rica.

### Learning objectives
see module description of the Universidad de Costa Rica.

### Syllabus
see module description of the Universidad de Costa Rica.

### Literature
see module description of the Universidad de Costa Rica.

### Teaching and learning methods
see module description of the Universidad de Costa Rica.

### Workload
see module description of the Universidad de Costa Rica.

### Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
| **Ecology of the Mediterranean**  
| Modules referring to Biodiversity/Ecology - Compulsory Electives |
|---|---|
| **Code** | 8802674007 |
| **ECTS credits** | 9 |
| **Attendance time** | 7 |
| **Language of instruction** | No english version available. |
| **Duration** | 1 Semester |
| **Cycle** | Summer Semester every two Years |
| **Coordinator** | No english version available. |
| **Instructor(s)** | No english version available. |
| **Allocation of study programmes** | No english version available. |
| **Recommended prerequisites** | No english version available. |
| **Learning objectives** | No english version available. |
| **Syllabus** | No english version available. |
| **Literature** | No english version available. |
| **Teaching and learning methods** | No english version available. |
| **Workload** | No english version available. |
| **Assessment** | No english version available. |
| **Grading procedure** | No english version available. |
Basis for

No english version available.
Ecology of Tropical Habitats
Modules referring to Biodiversity/Ecology - Compulsory Electives

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Steven Jansen</td>
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<td>Instructor(s)</td>
<td>Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka</td>
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<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester recommended</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme. Contentually: Module Biodiversity and Ecology.</td>
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<tr>
<td>Learning objectives</td>
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<tr>
<td></td>
<td>• have general knowledge about the ecology of tropical ecosystems.</td>
</tr>
<tr>
<td></td>
<td>• are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.</td>
</tr>
<tr>
<td></td>
<td>• know selected groups of organisms and interactions occurring in tropical ecosystems.</td>
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<tr>
<td></td>
<td>• have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.</td>
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<tr>
<td></td>
<td>• are capable to verify and analyze observations and experimental results and to present these orally and in writing.</td>
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</tbody>
</table>

Syllabus
This module covers the following subject-specific topics:

Lecture:
• Basic introduction to tropical ecosystems, incl. basics of climatology
• Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains
• Overview on important taxa of tropical plants and animals
• Animal-plant interaction in the tropics
• Specific threats to tropical ecosystems

Seminar:
• Presentation and discussion of selected publications on tropical ecology

Laboratory course:
• Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
• Ecophysiology of tropical plants
• Behavioral ecology and social organization of tropical bats
• Application and development of techniques for measuring tropical diversity

<table>
<thead>
<tr>
<th>Literature</th>
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<table>
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<th>Teaching and learning methods</th>
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<tbody>
<tr>
<td>• Tropical Ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]</td>
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<table>
<thead>
<tr>
<th>Basis for</th>
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</thead>
<tbody>
<tr>
<td>Master thesis in the area of ecology/biodiversity.</td>
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Soil and Water
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672161

ECTS credits 9

Attendance time 6

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Biology lecturers from following universities:
• Ulm University (Ulm, Germany)
• University of South Bohemia in Ceske Budejovice (Budweis, Czech Republic)
• Aix-Marseille University (Marseille, France)
• Estonian University of Life Sciences (Tartu, Estonia)

Allocation of study programmes
• Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester
• Biology MSc, start of studies: winter semester, optional module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester
• Biology Teacher Training, compulsory elective module, 5\textsuperscript{th}, 7\textsuperscript{th} or 9\textsuperscript{th} study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Students who have successfully completed this module
• have knowledge and competence regarding interactions between soils, plants and soil organisms with special emphasis on soil processes and effects of drought and flooding on plants and soil organisms.
• know the major risks of soil degradation.
• are familiar with the link between soil functions and societal needs and expectations.
**Syllabus**

This module covers the following subject-specific topics:

- Soil science
- Ecology
- Plant sciences
- Zoology

**Literature**

- Lectures notes and practical course notes
- Scientific articles for the seminars

**Teaching and learning methods**

- Lectures, 2 credit hours [SWS], 3 credit points [LP]
- Seminars, 1 credit hours [SWS], 2 credit points [LP]
- Practical courses / excursions, 3 credit hours [SWS], 4 credit points [LP]

**Workload**

- Attendance: 90 h
- Private study: 180 h
- Sum: 270 h

**Assessment**

Oral exam

**Grading procedure**

The exam grade is the module grade.

**Basis for**

Master thesis in the area of ecology/biodiversity
Field Ecology II
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802671561

ECTS credits 18

Attendance time 16

Language of instruction English

Duration 1 Semester

Cycle Summer Semester every two Years

Coordinator PD Dr. Marco Tschapka

Instructor(s) PD Dr. Marco Tschapka, Jun. Prof. Dr. Steven Jansen

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

Learning objectives Students who have successfully completed this module

• have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
• have a broad overview on animals and plants in tropical rainforests.
• have first experience with field work in a tropical ecosystem.
• are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
• have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
• have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
• have obtained first experience with international scientific cooperation.

Syllabus This module covers the following subject-specific topics:
• Tropical ecology, focussing on Costa Rican ecosystems
• Overview and practical experience with plants and animals of Central American rain forests
• Introduction to field work in the tropics (group projects and individual projects)
• Basics of scientific work, including literature studies
• Experimental design, statistical testing of hypotheses, write-up of results
• Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

Literature

Teaching and learning methods
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload
Attendance: 240 h
Private study: 300 h
Sum: 540 h

Assessment
Oral presentation in the seminar, laboratory course reports, written exam

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
### Field Ecology III

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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Basis for

No english version available.
Tropical Botany II - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673951

ECTS credits 9

Attendance time 8

Language of instruction No english version available.

Duration 1 Semester

Cycle each Summer Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure

No english version available.

Basis for

-
| **Tropical Botany IV - Universidad de Costa Rica**  
| Modules referring to Biodiversity/Ecology - Compulsory Electives |
|---|---|
| **Code** | 8802673953 |
| **ECTS credits** | 18 |
| **Attendance time** | 14 |
| **Language of instruction** | No english version available. |
| **Duration** | 1 Semester |
| **Cycle** | Summer Semester every two Years |
| **Coordinator** | Universidad de Costa Rica |
| **Instructor(s)** | Instructors of the Universidad de Costa Rica |

**Allocation of study programmes**

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Field Ecology II, Additional module

**Recommended prerequisites**

see module description of the Universidad de Costa Rica.

**Learning objectives**

see module description of the Universidad de Costa Rica.

**Syllabus**

see module description of the Universidad de Costa Rica.

**Literature**

see module description of the Universidad de Costa Rica.

**Teaching and learning methods**

see module description of the Universidad de Costa Rica.

**Workload**

see module description of the Universidad de Costa Rica.

**Assessment**

No english version available.
Grading procedure  No english version available.

Basis for  -
<table>
<thead>
<tr>
<th><strong>Tropical Ecology II - Universidad de Costa Rica</strong></th>
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</thead>
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<tr>
<td><strong>Modules referring to Biodiversity/Ecology - Compulsory Electives</strong></td>
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| **Code** | 8802673961 |
| **ECTS credits** | 9 |
| **Attendance time** | 8 |
| **Language of instruction** | Spanish |
| **Duration** | 1 Semester |
| **Cycle** | each Summer Semester |
| **Coordinator** | Universidad de Costa Rica |
| **Instructor(s)** | Instructors of the Universidad de Costa Rica |

| **Allocation of study programmes** | The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University: Ecology of the Mediterranean, Field Ecology III, Additional module |

| **Recommended prerequisites** | see module description of the Universidad de Costa Rica. |
| **Learning objectives** | see module description of the Universidad de Costa Rica. |
| **Syllabus** | see module description of the Universidad de Costa Rica. |
| **Literature** | see module description of the Universidad de Costa Rica. |
| **Teaching and learning methods** | see module description of the Universidad de Costa Rica. |
| **Workload** | see module description of the Universidad de Costa Rica. |
| **Assessment** | No english version available. |
Grading procedure
No English version available.

Basis for
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Grading procedure  No english version available.

Basis for  -
### Tropical Zoology II - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

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### Tropical Zoology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Duration</td>
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<td>Cycle</td>
<td>Summer Semester every two Years</td>
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<tr>
<td>Coordinator</td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
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#### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

#### Recommended prerequisites
see module description of the Universidad de Costa Rica.

#### Learning objectives
see module description of the Universidad de Costa Rica.

#### Syllabus
see module description of the Universidad de Costa Rica.

#### Literature
see module description of the Universidad de Costa Rica.

#### Teaching and learning methods
see module description of the Universidad de Costa Rica.

#### Workload
see module description of the Universidad de Costa Rica.

#### Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
Wetland Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672052

ECTS credits 9

Attendance time 7

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Jan Dickopp, Ph.D. Ing. Tomás Picek (primarily responsible), Dr. Martin Werth

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester;

Biology BSc, start of studies: winter semester, optional module, 1st, 3rd or 5th study semester;

Biology Teacher Training, start of studies: winter semester, compulsory elective module, 1st, 3rd, 5th, 7th or 9th study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Ecology [Ökologie], 2nd study semester BSc.

Learning objectives Students who have successfully completed this module

- possess general knowledge about wetland ecology.
- know concepts for anthropogenic use of wetlands.
- conducted student projects concerning wetland ecology from concept to report.
- have the ability to critically evaluate and present observations and experimental results.
- can prepare relevant literature for a time-limited talk.

Syllabus This module covers the following subject-specific topics:

Lecture:
• General introduction to various wetland ecosystems
• Types of wetlands
• Hydrology and soils
• Adaptations of plants
• Biogeochemistry
• Moors, tropical wetlands, coast wetlands
• Anthropogenic use: Use and destruction of moors, rice fields, constructed wetlands
• Protection, renaturation and management of wetlands

Seminar:
• Presentation and discussion of selected publications from the topic area of wetland ecology

Laboratory course and excursions:
• Basics of scientific working, incl. literature search, data acquisition, statistical analysis, report writing
• Ecophysiology of wetland plants (gas exchange, nutrient balance)
• Anatomy of wetland plants (aerenchyma, hyaline cells, …)
• Gas transport by wetland plants
• Capture of chemical parameters in soil and water

Literature

Teaching and learning methods
• Wetland ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Wetland ecology (seminar), 2 credit hours [SWS], 2+1 credit points [LP]
• Wetland ecology (laboratory course + excursion), 3 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 105 h
Private study: 165 h
Sum: 270 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
further courses in the area of ecology / ecosystem dynamics, theses in the Institute for Systematic Botany and Ecology
## Microbiology - Master

Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Bernhard Eikmanns</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel</td>
</tr>
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### Allocation of study programmes

- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 2\textsuperscript{nd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 2\textsuperscript{nd} study semester recommended

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).

### Learning objectives

Students who have successfully completed this module

- have extended knowledge on key topics in microbiology and molecular microbiology.
- have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.
- have gathered experience in actively discussing scientific presentations
- have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.
- are able to individually work under supervision on own topics related to current research.
This module covers the following subject-specific topics:

Lectures:

- Microbiology IV (Microbial Regulation):
  RNA: Structure and function: (Ribosomal RNA (rRNA); Transfer RNA (tRNA); Messenger RNA (mRNA); Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction {negative control}; Induction {positive control}; Repression {negative control}; Repression {positive control}; cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition!); Attenuation in *Escherichia coli* {amino acid biosynthesis}; Attenuation (antibiotic resistance induction); Attenuation (pyrimidine biosynthesis); Attenuation in *Bacillus subtilis* {amino acid biosynthesis}; Autogenic control; 2-Component systems ({*arc, ntr, che*}); FNR-dependent regulation; Sigma factor-dependent regulation {heat shock, nitrogen metabolism, sporulation}; T-box-dependent regulation; Regulation by modification of tRNA bases; antisenseRNA-dependent regulation {plasmid replication, osmoregulation}; Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing ({*Vibrio harveyi, Staphylococcus aureus*}); Regulation by rarely used tRNAs; Stringent response; Signal molecules
  Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)
- Host-Microbe Interactions:
  Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

- Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense

Laboratory course (Microbiology Advanced Course):

- Principles and methods of enrichment, isolation and characterization of microorganisms (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogenics; serological and enzymatic analysis of β-galactosidase in *Escherichia coli*; isolation and analysis of genes from *Acinetobacter* sp. and cloning of these genes; cultivation of *Ashbya gossypii* and analysis of substrate consumption and riboflavine formation by a mutant of this fungus; characterization of a key enzyme of riboflavine synthesis; growth, substrate consumption and glutamate production of *Corynebacterium glutamicum*; analysis of key enzymes of glutamate synthesis
- Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrecht); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment
### Literature


### Teaching and learning methods

- Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester
- Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester
- Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

### Workload

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<tr>
<th>Details</th>
<th>Hours</th>
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<tr>
<td>Attendance</td>
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<td>Private study</td>
<td>285</td>
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<td>Sum</td>
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</table>

### Assessment

Audited protocol, not graded; Successful participation at the seminar; not graded.

Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

### Grading procedure

The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

### Basis for

Master thesis in the Institute of Microbiology and Biotechnology
# Molecular Botany

**Modules referring to Molecular Biosciences - Compulsory Electives**

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>apl. Prof. Dr. Stefan Binder</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka</td>
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<td>Allocation of study programmes</td>
<td>Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1&lt;sup&gt;st&lt;/sup&gt; or 3&lt;sup&gt;rd&lt;/sup&gt; study semester recommended; Biology MSc, start of studies: winter semester, compulsory elective module, 1&lt;sup&gt;st&lt;/sup&gt; or 3&lt;sup&gt;rd&lt;/sup&gt; study semester recommended</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).</td>
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| Learning objectives | Students who have successfully completed this module  
- have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.  
- are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.  
- are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.  
- have expertise to judge and deliberate benefits and risks in green gene technology. |

## Syllabus

This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

<table>
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<tr>
<th>Literature</th>
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<tbody>
<tr>
<td>• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag</td>
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<td>• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag</td>
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<td>• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition</td>
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<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
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<tbody>
<tr>
<td>• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]</td>
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<tr>
<td>• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<th>Workload</th>
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<table>
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Endocrinology
Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Prof. Dr. Jan Tuckermann</td>
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<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Rőszer, Dr. Sabine Vettorazzi</td>
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<td>Allocation of study programmes</td>
<td>Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1&lt;sup&gt;st&lt;/sup&gt; or 3&lt;sup&gt;rd&lt;/sup&gt; study semester recommended; Biology MSc, start of studies: winter semester, compulsory elective module, 1&lt;sup&gt;st&lt;/sup&gt; or 3&lt;sup&gt;rd&lt;/sup&gt; study semester recommended</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Molecular Bioscience [Molekulare Biowissenschaften].</td>
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</table>
| Learning objectives   | Students who have successfully completed this module
• possess advanced knowledge about key issues in endocrinology and molecular endocrinology.
• have the ability for self-dependent preparation of a topic by original papers and to present it in a talk.
• are qualified for advanced practical work in a current research project in the area of molecular endocrinology. |
| Syllabus              | This module covers the following subject-specific topics:
• Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue. |
• Practice of working techniques in cell biology, protein chemistry and molecular biology.
• Summarizations of results in a work record respectively a poster as well as an oral presentation.

**Literature**

- Current textbooks about biochemistry as well as physiology

**Teaching and learning methods**

- Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

Attendance: 240 h
Private study: 300 h
Sum: 540 h

**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the Institute of Comparative Molecular Endocrinology
**Genetics**

Modules referring to Molecular Biosciences - Compulsory Electives

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<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Nils Johnsson</td>
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<tr>
<td>Instructor(s)</td>
<td>Dr. Alexander Dünkler, Dr. Thomas Gronemeyer, Prof. Dr. Nils Johnsson</td>
</tr>
</tbody>
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**Allocation of study programmes**

- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in genetics and cell biology; e.g. module Developmental Biology and Genetics [Entwicklungsbiologie und Genetik] (BSc Biology), module Microbiology and Genetics [Mikrobiologie und Genetik] (BSc Biochemistry) or module Molecular Developmental Biology and Oncology [Molekulare Entwicklungsbiologie und Onkologie] (BSc Biochemistry).

**Learning objectives**

Students who have successfully completed this module

- have profound knowledge about the regulation of polarized growth and asymmetric cell division including the required theoretical background.
- have knowledge of the required laboratory techniques to answer subject specific questions on the basis of experiments.
- are capable of self-sustained preparation of a subject based on scientific literature and oral presentation including discussion.

**Syllabus**

This module covers the following subject-specific topics:
• Theoretical background covering the topics intracellular protein transport, protein secretion, cell division and the regulation of these events
• Hands-on application of genetic, cell biological and protein chemical techniques in the context of a current research project
• Oral presentation of the experimental results and preparation of a written report

Literature
• Molecular Cell Biology. Lodish et al. Freeman 2008
• Biochemistry. Voet & Voet Wiley VCH 2011

Teaching and learning methods
• Molecular Cell Biology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Molecular Cell Biology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Laboratory Course Genetics [Großpraktikum Genetik] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload
Attendance: 240 h
Private study: 300 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
-
<table>
<thead>
<tr>
<th><strong>Conservation Genomics and Molecular Biology</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modules referring to Molecular Biosciences - Compulsory Electives</strong></td>
<td></td>
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<tr>
<td><strong>Code</strong></td>
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<td><strong>Duration</strong></td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Summer Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>not specified</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>not specified</td>
</tr>
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<td><strong>Allocation of study programmes</strong></td>
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<tr>
<td><strong>Recommended prerequisites</strong></td>
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<td><strong>Learning objectives</strong></td>
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<td><strong>Assessment</strong></td>
<td>not specified</td>
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<td><strong>Grading procedure</strong></td>
<td>not specified</td>
</tr>
<tr>
<td><strong>Basis for</strong></td>
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</table>
## Protein Biochemistry
Modules referring to Molecular Biosciences - Compulsory Electives

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<td>Duration</td>
<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marcus Fändrich</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module;
- Biology MSc, start of studies: winter semester, compulsory elective module

### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

### Learning objectives
Students who have successfully completed this module
- have a broad overview on the structural properties of proteins,
- know relevant techniques to structurally investigate proteins,
- have insight in the most important protein-folding diseases,
- are trained in planning scientific experiments themselves,
- are trained in giving a scientific talk.

### Syllabus
This module covers the following subject-specific topics:
- Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
- Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
• Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer's disease, Parkinson's disease, bovine spongiform encephalopathy (BSE), scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA, AL and ATTR amyloidosis, etc.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Will be announced in the courses</th>
</tr>
</thead>
</table>

| Teaching and learning methods | • Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]  
• Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]  
• Protein Biochemistry (laboratory course), 12 credit hours [SWS], 12 credit points [LP] |
|-----------------------------|---------------------------------------------------------------------|

| Workload | Attendance time: 240 h  
Private study: 300 h  
Sum: 540 h |
|-----------|---------------------------------------------------------------|

| Assessment | Attested report, ungraded. Successful participation in the seminar, ungraded.  
Written exam, graded. |
|-------------|---------------------------------------------------------------------|

<table>
<thead>
<tr>
<th>Grading procedure</th>
<th>The grade is determined from the result of the exam.</th>
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</table>

<table>
<thead>
<tr>
<th>Basis for</th>
<th>Master thesis in protein biochemistry.</th>
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### Patent Law

Modules referring to Compulsory Elective

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<td><strong>Attendance time</strong></td>
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<td><strong>Language of instruction</strong></td>
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<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Dean of studies (chemistry department)</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Dr. Helmut Reitzle</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

- Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1\(^{st}\) study semester;
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module

- have knowledge about the fundamentals of the patent system.

**Syllabus**

This module covers the following subject-specific topics:

- Part 1: Rights of use, exhaustion of rights of use using powers, mediate patent infringement, right of prior use, restriction of the effect of the patent, extend of protection, infringement of the protective right, the rights to the invention.
- Part 2: Novelty, the inventive step, industrial application.
- Part 3: procedural law, general rules, representation, patent application, procedure up to granting, eliminations of patents, objection, nullity.

**Literature**

Literature will be provided in the lecture
| Teaching and learning methods | • Patent Right for Natural Scientists [Patentrecht für Naturwissenschaftler] (lecture), 1 credit hour [SWS], 3 credit points [LP] |
| Workload | Attendance: 15 h  
Private study: 75 h  
Sum: 90 h |
| Assessment | Compulsory attendance, absence on maximally one appointment is tolerated (except excursion) |
| Grading procedure | The module is not graded. |
| Basis for | - |
## Medical Products

**Modules referring to Compulsory Elective**

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<td><strong>Language of instruction</strong></td>
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<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Peter Gierschik</td>
</tr>
</tbody>
</table>

**Instructor(s)**
- Dr. Thomas Bräuner
- Dieter Eckhardt
- Dr. Karl Heinz Emmert
- Dr. Armin Frey
- Prof. Dr. Peter Gierschik
- Dr. Udo Hartlaub
- Dr. Thomas Kammermeier
- Dr. Thomas Lamprecht
- Dr. Eberhardt Landsbeck
- Dr. Rainer Winstel

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester;
- Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester

### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

**Contentually: No information.**

### Learning objectives

Students who have successfully completed this module

- have knowledge about drug development in general, as well as on the level of chemistry/pharmaceutics and pharmacology/toxicology in special, under consideration of corresponding legal rules and standards.
- know the legal requirements for first clinical application of new pharmaceuticals.
- have a clear idea how clinical studies are designed and they know how to interpret and assess corresponding data.
- have knowledge about safety and regulation of pharmaceutical products.

### Syllabus

This module covers the following subject-specific topics:

- Introduction, history of drug development, procedure outline of a drug development, rules and standards
• Chemical/pharmaceutical development I: Development of active pharmaceutical ingredients
• Chemical/pharmaceutical development II: Development of final products
• Pharmacological/toxicological development I: From drug discovery and pre-clinical development to first application on human beings
• Pharmacological/toxicological development II: Toxicology and safety issues of pharmacology
• Pharmacological/toxicological development III: Pharmacokinetics and metabolism
• Clinical development: From first application on human beings to proof of efficiency and safety
• Planning and execution of rules and standards
• Pharmaceutical product information and labeling
• Safety of pharmaceutical products: Basics
• Safety of pharmaceutical products: Structure and risk management
• Biopharmaceutical drugs: Development, production and control
• Generic medicaments: Quality, substitution
• Regulation of pharmaceutical products in Germany
• Regulation of pharmaceutical products in the European Union

<table>
<thead>
<tr>
<th>Literature</th>
<th>No information</th>
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</table>

<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>W 68 Development, Regulation and Monitoring of Medical Products [W 68 Entwicklung, Zulassung und Überwachung von Arzneimitteln] (seminar), 1 credit hour [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>

| Workload                        | Attendance: 15 h  
Private study: 75 h  
Sum: 90 h |
|---------------------------------|----------------------------------------------------------------|

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Evidence of course achievement</th>
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<table>
<thead>
<tr>
<th>Grading procedure</th>
<th>The module is not graded.</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Basis for</th>
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### Quality Control

Modules referring to Compulsory Elective

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<td>Language of instruction</td>
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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Dr. Frank Rosenau</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Frank Rosenau, Dr. Frank Bengelsdorf</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lectures (basic laboratory courses, respectively) in microbiology, biochemistry, chemistry, pharmacy.

**Learning objectives**

Students who have successfully completed this module

- possess fundamental knowledge about installation and operation of pharmaceutical productions processes in the scope of legal regulations.
- are qualified to understand pharmaceutical production by real practical examples.
- achieve a theoretical preparation to an important potential occupational area.

**Syllabus**

This module covers the following subject-specific topics:

- Quality assurance and sterilization/validation of medical devices
- Development, production and pharmaceutical formulation of therapeutic glycoproteins
- Bioanalytical methods under GLP conditions
- Hygienic design of pharmaceutical production facilities
- Chemical quality controls of active agents and additives
- Rules and standards, inspection authorities: GMP and GLP
- Microbiology in the pharmaceutical industry
- New technologies and strategies for analysis of pharmaceutics
- Biotechnological production of biosimilars
- Design of production facilities at various culture techniques and production organisms

<table>
<thead>
<tr>
<th>Literature</th>
<th>PowerPoint slides from the presentations of the lecturers (incl. cited sources) will be sent to the participants via an email list.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching and learning methods</td>
<td>Quality Management [Qualitätssicherung] (lecture), 2 credit hours [SWS], 3 credit points [LP]</td>
</tr>
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</table>
| Workload | Attendance: 30 h  
Private study: 60 h  
Sum: 90 h |
| Assessment | Attendance as evidence of course achievement |
| Grading procedure | The module is not graded. |
| Basis for | - |
### Basic Statistics for Biologists

Modules referring to Compulsory Elective

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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>PD Dr. Marco Tschapka</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Markus Metz, Dr. Swen Renner, PD Dr. Jutta Schmid</td>
</tr>
</tbody>
</table>

#### Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

#### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge on principles of data collection and data analysis.

#### Learning objectives

Students who have successfully completed this module

- have basic knowledge in statistics.
- are capable to operate the statistics package R, using the graphic user interface *R commander*.
- know how to collect and organize data and perform data analysis.

#### Syllabus

This module covers the following subject-specific topics:

- Theoretical and practical knowledge on performing basic statistic tests (simple tests, multivariate statistics)
- Exercises, using the software package R

#### Literature

- R script
- Sachs, Angewandte Statistik (2002)
- Sokal und Rohlf, Biometry (1981)
<table>
<thead>
<tr>
<th><strong>Teaching and learning methods</strong></th>
<th>• Statistics (lecture/exercise), 2 credit hours [SWS], 3 credit points [LP]</th>
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</table>
| **Workload**                     | Attendance time: 30 h  
Private study: 60 h  
Sum: 90 h |
| **Assessment**                   | Terminal written exam |
| **Grading procedure**            | No grades; exam must be passed by >50% |
| **Basis for**                    | Modules in the special subject Biodiversity and Ecology |
Excursion
Modules referring to Compulsory Elective

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<td>Cycle</td>
<td>each Summer Semester</td>
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<tr>
<td>Coordinator</td>
<td>Dr. Philipp von Wrangell</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Lecturers from the faculty of biology</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester</td>
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<td>Learning objectives</td>
<td>Students who have successfully completed this module</td>
</tr>
<tr>
<td></td>
<td>• learned the characteristics of flora and fauna of exemplary ecosystems.</td>
</tr>
<tr>
<td></td>
<td>• have knowledge about ecological relations, interactions between organisms, interactions between organisms and their biotic and abiotic environment</td>
</tr>
<tr>
<td></td>
<td>• have knowledge about the human influence on ecosystems and their stability exemplified on natural or close to nature systems but also on typical cultural landscape systems.</td>
</tr>
<tr>
<td></td>
<td>• learned (depending on the excursions destination) methods of landscape management and environment protection.</td>
</tr>
<tr>
<td>Syllabus</td>
<td>This module covers the following subject-specific topics:</td>
</tr>
<tr>
<td></td>
<td>• Knowledge of flora and fauna</td>
</tr>
<tr>
<td></td>
<td>• Understanding of ecosystematic relations</td>
</tr>
<tr>
<td></td>
<td>• Influence of humans on ecosystems</td>
</tr>
<tr>
<td></td>
<td>• Landscape management (where applicable)</td>
</tr>
<tr>
<td></td>
<td>• Methods of environment protection (where applicable)</td>
</tr>
<tr>
<td>Literature</td>
<td>Depending on the excursion destination</td>
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<tr>
<td><strong>Teaching and learning methods</strong></td>
<td>Compulsory elective Excursion [Wahlpflicht Exkursion] (excursion), 3 credit hours [SWS], 3 credit points [LP]</td>
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<td><strong>Basis for</strong></td>
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### Advanced Neurobiology

**Modules referring to Neurobiology - Compulsory Electives**

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<tr>
<td>Duration</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended
- Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

**Learning objectives**

Students who have successfully completed this module

- have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
- have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
- are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

**Syllabus**

This module covers the following subject-specific topics:
Lectures:

• Energetics and allometry of animal movement
• Properties of ion channels and their contribution to neuronal excitation
• Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
• Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

• Experimental und theoretical treatment of the above mentioned topics (selected examples)

Literature

• Specific literature for laboratory course and seminar topics

Teaching and learning methods

• Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]
• Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload

Attendance: 270 h
Private study: 360 h
Sum: 630 h

Assessment


Grading procedure

The grade of the module will be the grade of the exam.

Basis for

Master thesis in the area of behavioral biology or neurobiology
Behavioral Physiology
Modules referring to Neurobiology - Compulsory Electives

Code 8802670561

ECTS credits 21

Attendance time 18

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Harald Wolf

Instructor(s) Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf

Allocation of study programmes
• Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended
• Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2nd study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

Learning objectives Students who have successfully completed this module
• know the elements and their function in neural control circuits, including efferent and behavioral control.
• have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
• are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
• have gained practical experience in handling laboratory animals.
• are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
• have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
Syllabus
This module covers the following subject-specific topics:

Lecture Behavioral Physiology:
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

Lab course and seminar Behavioral Physiology:
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

Literature
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

Teaching and learning methods
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

Workload
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of neurobiology or behavioral biology
## Patent Law

Modules referring to Compulsory Elective

<table>
<thead>
<tr>
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<td>Language of instruction</td>
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<tr>
<td>Duration</td>
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</tr>
<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Dean of studies (chemistry department)</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Helmut Reitzle</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester;
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.

### Learning objectives
- Students who have successfully completed this module
  - have knowledge about the fundamentals of the patent system.

### Syllabus
- This module covers the following subject-specific topics:
  - Part 1: Rights of use, exhaustion of rights of use using powers, mediate patent infringement, right of prior use, restriction of the effect of the patent, extend of protection, infringement of the protective right, the rights to the invention.
  - Part 2: Novelty, the inventive step, industrial application.
  - Part 3: procedural law, general rules, representation, patent application, procedure up to granting, eliminations of patents, objection, nullity.

### Literature
- Literature will be provided in the lecture
<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>• Patent Right for Natural Scientists [Patentrecht für Naturwissenschaftler] (lecture), 1 credit hour [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>
| Workload                     | Attendance: 15 h  
Private study: 75 h  
Sum: 90 h |
| Assessment                   | Compulsory attendance, absence on maximally one appointment is tolerated (except excursion) |
| Grading procedure            | The module is not graded. |
| Basis for                    | - |
Medical Products
Modules referring to Compulsory Elective

Code 8802671712

ECTS credits 3

Attendance time 1

Language of instruction German

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Peter Gierschik

Instructor(s) Dr. Thomas Bräuner, Dr. Dieter Eckhardt, Dr. Karl Heinz Emmert, Dr. Armin Frey, Prof. Dr. Peter Gierschik, Dr. Udo Hartlaub, Dr. Thomas Kammermeier, Dr. Thomas Lamprecht, Dr. Eberhardt Landsbeck, Dr. Rainer Winstel

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester;

Biology MSc, start of studies: winter semester, compulsory elective module in special subject Molecular Bioscience, 1st study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: No information.

Learning objectives Students who have successfully completed this module
• have knowledge about drug development in general, as well as on the level of chemistry/pharmaceutics and pharmacology/toxicology in special, under consideration of corresponding legal rules and standards.
• know the legal requirements for first clinical application of new pharmaceuticals.
• have a clear idea how clinical studies are designed and they know how to interpret and assess corresponding data.
• have knowledge about safety and regulation of pharmaceutical products.

Syllabus This module covers the following subject-specific topics:
• Introduction, history of drug development, procedure outline of a drug development, rules and standards
• Chemical/pharmaceutical development I: Development of active pharmaceutical ingredients
• Chemical/pharmaceutical development II: Development of final products
• Pharmacological/toxicological development I: From drug discovery and pre-clinical development to first application on human beings
• Pharmacological/toxicological development II: Toxicology and safety issues of pharmacology
• Pharmacological/toxicological development III: Pharmacokinetics and metabolism
• Clinical development: From first application on human beings to proof of efficiency and safety
• Planning and execution of rules and standards
• Pharmaceutical product information and labeling
• Safety of pharmaceutical products: Basics
• Safety of pharmaceutical products: Structure and risk management
• Biopharmaceutical drugs: Development, production and control
• Generic medicaments: Quality, substitution
• Regulation of pharmaceutical products in Germany
• Regulation of pharmaceutical products in the European Union

Literature

No information

Teaching and learning methods

• W 68 Development, Regulation and Monitoring of Medical Products [W 68 Entwicklung, Zulassung und Überwachung von Arzneimitteln] (seminar), 1 credit hour [SWS], 3 credit points [LP]

Workload

Attendance: 15 h
Private study: 75 h
Sum: 90 h

Assessment

Evidence of course achievement

Grading procedure

The module is not graded.

Basis for

-
Quality Control
Modules referring to Compulsory Elective

**Code** 8802670556

**ECTS credits** 3

**Attendance time** 2

**Language of instruction** German

**Duration** 1 Semester

**Cycle** each Summer Semester

**Coordinator** Dr. Frank Rosenau

**Instructor(s)** Dr. Frank Rosenau, Dr. Frank Bengelsdorf

**Allocation of study programmes**

- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lectures (basic laboratory courses, respectively) in microbiology, biochemistry, chemistry, pharmacy.

**Learning objectives**

Students who have successfully completed this module

- possess fundamental knowledge about installation and operation of pharmaceutical productions processes in the scope of legal regulations.
- are qualified to understand pharmaceutical production by real practical examples.
- achieve a theoretical preparation to an important potential occupational area.

**Syllabus**

This module covers the following subject-specific topics:

- Quality assurance and sterilization/validation of medical devices
- Development, production and pharmaceutical formulation of therapeutic glycoproteins
- Bioanalytical methods under GLP conditions
- Hygienic design of pharmaceutical production facilities
- Chemical quality controls of active agents and additives
- Rules and standards, inspection authorities: GMP and GLP
- Microbiology in the pharmaceutical industry
- New technologies and strategies for analysis of pharmaceutics
- Biotechnological production of biosimilars
- Design of production facilities at various culture techniques and production organisms

<table>
<thead>
<tr>
<th>Literature</th>
<th>PowerPoint slides from the presentations of the lecturers (incl. cited sources) will be sent to the participants via an email list.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching and learning methods</td>
<td>Quality Management [Qualitätssicherung] (lecture), 2 credit hours [SWS], 3 credit points [LP]</td>
</tr>
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</table>
| Workload | Attendance: 30 h  
Private study: 60 h  
Sum: 90 h |
| Assessment | Attendance as evidence of course achievement |
| Grading procedure | The module is not graded. |
| Basis for | - |
Basic Statistics for Biologists
Modules referring to Compulsory Elective

Code 8802670564

ECTS credits 3

Attendance time 2

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator PD Dr. Marco Tschapka

Instructor(s) Dr. Markus Metz, Dr. Swen Renner, PD Dr. Jutta Schmid

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Basic knowledge on principles of data collection and data analysis.

Learning objectives Students who have successfully completed this module
• have basic knowledge in statistics.
• are capable to operate the statistics package R, using the graphic user interface R commander.
• know how to collect and organize data and perform data analysis.

Syllabus This module covers the following subject-specific topics:
• Theoretical and practical knowledge on performing basic statistic tests (simple tests, multivariate statistics)
• Exercises, using the software package R

Literature • R script
• Sachs, Angewandte Statistik (2002)
• Sokal und Rohlf, Biometry (1981)
<table>
<thead>
<tr>
<th><strong>Teaching and learning methods</strong></th>
<th>• Statistics (lecture/exercise), 2 credit hours [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>
| **Workload**                  | Attendance time: 30 h  
                             | Private study: 60 h  
                             | Sum: 90 h |
| **Assessment**                | Terminal written exam |
| **Grading procedure**         | No grades; exam must be passed by >50% |
| **Basis for**                 | Modules in the special subject Biodiversity and Ecology |
# Excursion
Modules referring to Compulsory Elective

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<td>Language of instruction</td>
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<tr>
<td>Duration</td>
<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Dr. Philipp von Wrangell</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Lecturers from the faculty of biology</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module

- learned the characteristics of flora and fauna of exemplary ecosystems.
- have knowledge about ecological relations, interactions between organisms, interactions between organisms and their biotic and abiotic environment
- have knowledge about the human influence on ecosystems and their stability exemplified on natural or close to nature systems but also on typical cultural landscape systems.
- learned (depending on the excursions destination) methods of landscape management and environment protection.

**Syllabus**

This module covers the following subject-specific topics:

- Knowledge of flora and fauna
- Understanding of ecosystematic relations
- Influence of humans on ecosystems
- Landscape management (where applicable)
- Methods of environment protection (where applicable)
<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th>Depending on the excursion destination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching and learning methods</strong></td>
<td>Compulsory elective Excursion [Wahlpflicht Exkursion] (excursion), 3 credit hours [SWS], 3 credit points [LP]</td>
</tr>
</tbody>
</table>
| **Workload** | Attendance time: 45 h  
Private study: 45 h  
Sum: 90 h |
| **Assessment** | Successful participation |
| **Grading procedure** | Ungraded |
| **Basis for** | - |
# Advanced Neurobiology

**Modules referring to Neurobiology - Compulsory Electives**

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<td>Language of instruction</td>
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<td>Duration</td>
<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended
- Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1st study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

**Learning objectives**

Students who have successfully completed this module

- have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
- have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
- are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

**Syllabus**

This module covers the following subject-specific topics:
Lectures:

- Energetics and allometry of animal movement
- Properties of ion channels and their contribution to neuronal excitation
- Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
- Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

- Experimental und theoretical treatment of the above mentioned topics (selected examples)

**Literature**

- Specific literature for laboratory course and seminar topics

**Teaching and learning methods**

- Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**


**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of behavioral biology or neurobiology
## Behavioral Physiology

Modules referring to Neurobiology - Compulsory Electives

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<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended
- Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2nd study semester

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives
Students who have successfully completed this module
- know the elements and their function in neural control circuits, including efferent and behavioral control.
- have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
- are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
- have gained practical experience in handling laboratory animals.
- are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
- have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
This module covers the following subject-specific topics:

**Lecture Behavioral Physiology:**
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

**Lab course and seminar Behavioral Physiology:**
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

**Literature**
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

**Teaching and learning methods**
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the area of neurobiology or behavioral biology
Advanced Systematics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802670565

ECTS credits 9

Attendance time 8

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Dieter Waloßek

Instructor(s) Dipl.Biol. Verena Kutschera, apl. Prof. Dr. Andreas Maas, Prof. Dr. Dieter Waloßek

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives Students who have successfully completed this module
• possess a deepened knowledge about Crustacea as an example of a species-rich and morphologically diverse taxon within the Arthropoda and Metazoa in general, about modern research approaches and methods, make use of modern thoughts about evolution and phylogeny.
• are capable to evaluate different theoretical explanatory models in the light of current research results on a specific animal taxon, which (a) represents the largest marine animal group with (b) sometimes extreme deviations from earlier ground patterns, is (c) known from more than half a Billion years old fossils and with since then diverging evolutionary lineages, but (d) is presented very mistakably in traditional teaching and text books.
• know about special scientific literature for own investigations, the development of small projects, writing of reports and about the application of different methods of and investigation and documentation to particular problems and animal material.

Syllabus This module covers the following subject-specific topics:
• External morphology of Crustacea and changes of ground-pattern conditions in the evolutionary lineage towards living representatives; specific focus is laid on the locomotory and feeding apparatus as important aspects in the life and evolution of animals. The two main taxa Entomostraca and Malacostraca are substantiated as monophyla.
• Examples of selected taxa to be investigated using various methods, including dissection, investigation and documentation, including scanning electron microscopy and modern light microscopy techniques. More aspects are the ontogeny (e.g., culture of developmental stages), material collection in the field and consideration of functional morphology.
• Theory and methods of phylogenetic systematics as a backbone and methodological approach to investigations of interrelationships of taxa.

Literature
• Storch, V. & Welsch, U.: Kükenthal – Zoologisches Praktikum. Elsevier Spektrum Akademischer Verlag
• Own course guide with additional information to the studied objects, advice for sectioning and terminologies
• Handouts with additional information on the morphology and phylogeny of the relevant taxa
• Script of the lecture "Funktionsmorphologie der Tiere" [in German] from bachelor study
• Relevant literature on Crustacea and special scientific papers

Teaching and learning methods
• Morphology, Systematics and Phylogeny of Crustacea (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Morphology, Systematics and Phylogeny of Crustacea (laboratory course), 6 credit hours [SWS], 9 credit points [LP]

Workload
Attendance time: 120 h
Private study: 150 h
Sum: 270 h

Assessment
Ungraded protocol with drawings and other documentaries, photographs, SEM micrographs, etc. Graded oral examination (or, if necessary, written examination).

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in biodiversity / zoological systematics
Chemical Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802674168

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Manfred Ayasse

Instructor(s) Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomashko

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives Students who have successfully completed this module

• have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.
• can apply modern methods used in chemical ecology and behavioral ecology.
• have basic knowledge on the biology and ecology of social insects.

Syllabus This module covers the following subject-specific topics:

Lecture/seminar:

• Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (allomones), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.
• In-depth information about the biology of social insects.
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:
Experiments on behavioral ecology and sociobiology of insects.
Application of important methods used in chemical ecology.
Apart from the specific content, basic methods used in scientific writing are taught as well.

**Literature**
- Further literature is presented during the course.

**Teaching and learning methods**
- Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
- Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

**Workload**
- Attendance: 120 h
- Private study: 150 h
- Sum: 270 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the area of chemical ecology
### Evolutionary Ecology: Interactions of Organisms

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Cycle</td>
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<tr>
<td>Workload</td>
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<tr>
<td>Assessment</td>
<td>The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.</td>
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<tr>
<td>Grading procedure</td>
<td>The grade of the module will be the grade of the exam.</td>
</tr>
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</table>
Basis for

No english version available yet.
Conservation Genomics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673045

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Simone Sommer

Instructor(s) Prof. Dr. Simone Sommer, Dr. Pablo Santos, Dr. Sebastian Menke

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie]. But also possible: Molecular Biology / Microbiology

Learning objectives Students who have successfully completed this module

• have basic knowledge about the principles and concepts of population and conservation genetics that influence genetic diversity and wildlife health
• have a good overview on the methods currently used to assess genetic diversity, as well as their advantages and limitations
• understand the functional importance of immune gene variability (MHC) in life history decisions (mate choice), evolutionary ecology (parasite and pathogen resistance) and conservation (population health)
• have a good overview on what drives gut bacterial diversity (microbiome) as well as associated health effects in wildlife species
• can apply selected modern methods used in evolutionary genetics and conservation genomics
• are able to perform efficient data mining and are able to handle and process large amounts of genetic sequences

Syllabus Lecture/seminar:
• Concepts in population and conservation genetics
• In-depth information on various genetic markers used in population and conservation genetics and possible applications
• Next generation sequencing technologies: overview, chances and caveats
• Basic knowledge of sequence databases, genome repositories and other online resources of genetic data for evolutionary biologists
• Introduction of the most important genetic software packages for data analysis
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:
• Primer design in non-model organisms, i.e. wildlife species
• Molecular lab work: genetic data generation to measure genetic diversity in an evolutionary and conservation context
• Basics in bioinformatic data processing with a focus on MHC and microbiome data
• Application of genetic software packages for data analyses (e.g. BLAST, alignments and assembly tools, building phylogenetic trees)
• Apart from the specific content, basic methods used in scientific writing are taught as well.

Literature
• Further literature will be presented during the course

Teaching and learning methods
• Conservation Genomics (lecture), 4 credit hours [SWS], 4 credit points [LP]
• Conservation Genomics (seminar), 2 credit hours [SWS], 2 credit points [LP]
• Conservation Genomics (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 120 h
Private study: 150 h
Sum: 270 h

Assessment
No english version available yet.

Grading procedure
No english version available yet.

Basis for
Master thesis in the area of conservation genomics and EcoHealth.
### Tropical Conservation II - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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#### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

#### Recommended prerequisites
see module description of the Universidad de Costa Rica.

#### Learning objectives
see module description of the Universidad de Costa Rica.

#### Syllabus
see module description of the Universidad de Costa Rica.

#### Literature
see module description of the Universidad de Costa Rica.

#### Teaching and learning methods
see module description of the Universidad de Costa Rica.

#### Workload
see module description of the Universidad de Costa Rica.

#### Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
# Tropical Conservation IV - Universidad de Costa Rica

*Modules referring to Biodiversity/Ecology - Compulsory Electives*

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### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

### Recommended prerequisites
see module description of the Universidad de Costa Rica.

### Learning objectives
see module description of the Universidad de Costa Rica.

### Syllabus
see module description of the Universidad de Costa Rica.

### Literature
see module description of the Universidad de Costa Rica.

### Teaching and learning methods
see module description of the Universidad de Costa Rica.

### Workload
see module description of the Universidad de Costa Rica.

### Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
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Basis for

No english version available.
Ecology of Tropical Habitats
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code: 8802674170

ECTS credits: 12

Attendance time: keine Angaben

Language of instruction: English

Duration: 1 Semester

Cycle: each Winter Semester

Coordinator: Prof. Dr. Steven Jansen

Instructor(s): Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka

Allocation of study programmes: Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester recommended

Recommended prerequisites: Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme. Contentually: Module Biodiversity and Ecology.

Learning objectives: Students who have successfully completed this module

• have general knowledge about the ecology of tropical ecosystems.
• are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.
• know selected groups of organisms and interactions occurring in tropical ecosystems.
• have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.
• are capable to verify and analyze observations and experimental results and to present these orally and in writing.

Syllabus: This module covers the following subject-specific topics:

Lecture:

• Basic introduction to tropical ecosystems, incl. basics of climatology
• Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains
- Overview on important taxa of tropical plants and animals
- Animal-plant interaction in the tropics
- Specific threats to tropical ecosystems

Seminar:
- Presentation and discussion of selected publications on tropical ecology

Laboratory course:
- Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
- Ecophysiology of tropical plants
- Behavioral ecology and social organization of tropical bats
- Application and development of techniques for measuring tropical diversity

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<td>Master thesis in the area of ecology/biodiversity.</td>
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# Soil and Water

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Prof. Dr. Marian Kazda</td>
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### Instructor(s)

Biology lecturers from following universities:

- Ulm University (Ulm, Germany)
- University of South Bohemia in Ceske Budejovice (Budweis, Czech Republic)
- Aix-Marseille University (Marseille, France)
- Estonian University of Life Sciences (Tartu, Estonia)

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester
- Biology MSc, start of studies: winter semester, optional module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester
- Biology Teacher Training, compulsory elective module, 5\textsuperscript{th}, 7\textsuperscript{th} or 9\textsuperscript{th} study semester

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

### Learning objectives

Students who have successfully completed this module

- have knowledge and competence regarding interactions between soils, plants and soil organisms with special emphasis on soil processes and effects of drought and flooding on plants and soil organisms.
- know the major risks of soil degradation.
- are familiar with the link between soil functions and societal needs and expectations.
Syllabus

This module covers the following subject-specific topics:

- Soil science
- Ecology
- Plant sciences
- Zoology

Literature

- Lectures notes and practical course notes
- Scientific articles for the seminars

Teaching and learning methods

- Lectures, 2 credit hours [SWS], 3 credit points [LP]
- Seminars, 1 credit hours [SWS], 2 credit points [LP]
- Practical courses / excursions, 3 credit hours [SWS], 4 credit points [LP]

Workload

Attendance: 90 h
Private study: 180 h
Sum: 270 h

Assessment

Oral exam

Grading procedure

The exam grade is the module grade.

Basis for

Master thesis in the area of ecology/biodiversity
Field Ecology II
Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**
Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

**Learning objectives**
Students who have successfully completed this module

- have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
- have a broad overview on animals and plants in tropical rainforests.
- have first experience with field work in a tropical ecosystem.
- are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
- have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
- have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
- have obtained first experience with international scientific cooperation.

**Syllabus**
This module covers the following subject-specific topics:
• Tropical ecology, focussing on Costa Rican ecosystems
• Overview and practical experience with plants and animals of Central American rain forests
• Introduction to field work in the tropics (group projects and individual projects)
• Basics of scientific work, including literature studies
• Experimental design, statistical testing of hypotheses, write-up of results
• Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

Literature

Teaching and learning methods
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload
Attendance: 240 h
Private study: 300 h
Sum: 540 h

Assessment
Oral presentation in the seminar, laboratory course reports, written exam

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
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Basis for

No english version available.
### Tropical Botany II - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

No english version available.
Grading procedure  
No english version available.

Basis for  
-
### Tropical Botany IV - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
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Grading procedure  No english version available.

Basis for  -
**Tropical Ecology II - Universidad de Costa Rica**

Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure

No english version available.

Basis for

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### Tropical Ecology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Field Ecology II, Additional module

**Recommended prerequisites**

see module description of the Universidad de Costa Rica.

**Learning objectives**

see module description of the Universidad de Costa Rica.

**Syllabus**

see module description of the Universidad de Costa Rica.

**Literature**

see module description of the Universidad de Costa Rica.

**Teaching and learning methods**

see module description of the Universidad de Costa Rica.

**Workload**

see module description of the Universidad de Costa Rica.

**Assessment**

No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Zoology II - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
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Grading procedure  No english version available.

Basis for  -
## Tropical Zoology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Coordinator</td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
</tbody>
</table>

### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

### Recommended prerequisites

see module description of the Universidad de Costa Rica.

### Learning objectives

see module description of the Universidad de Costa Rica.

### Syllabus

see module description of the Universidad de Costa Rica.

### Literature

see module description of the Universidad de Costa Rica.

### Teaching and learning methods

see module description of the Universidad de Costa Rica.

### Workload

see module description of the Universidad de Costa Rica.

### Assessment

No english version available.
Grading procedure  No english version available.

Basis for  -
Wetland Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672052

ECTS credits 9

Attendance time 7

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Jan Dickopp, Ph.D. Ing. Tomás Picek (primarily responsible), Dr. Martin Werth

Allocation of study programmes
Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester;

Biology BSc, start of studies: winter semester, optional module, 1st, 3rd or 5th study semester;

Biology Teacher Training, start of studies: winter semester, compulsory elective module, 1st, 3rd, 5th, 7th or 9th study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Ecology [Ökologie], 2nd study semester BSc.

Learning objectives
Students who have successfully completed this module

• possess general knowledge about wetland ecology.
• know concepts for anthropogenic use of wetlands.
• conducted student projects concerning wetland ecology from concept to report.
• have the ability to critically evaluate and present observations and experimental results.
• can prepare relevant literature for a time-limited talk.

Syllabus
This module covers the following subject-specific topics:

Lecture:
• General introduction to various wetland ecosystems
• Types of wetlands
• Hydrology and soils
• Adaptations of plants
• Biogeochemistry
• Moors, tropical wetlands, coast wetlands
• Anthropogenic use: Use and destruction of moors, rice fields, constructed wetlands
• Protection, renaturation and management of wetlands

Seminar:
• Presentation and discussion of selected publications from the topic area of wetland ecology

Laboratory course and excursions:
• Basics of scientific working, incl. literature search, data acquisition, statistical analysis, report writing
• Ecophysiology of wetland plants (gas exchange, nutrient balance)
• Anatomy of wetland plants (aerenchyma, hyaline cells, …)
• Gas transport by wetland plants
• Capture of chemical parameters in soil and water

Literature

Teaching and learning methods
• Wetland ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Wetland ecology (seminar), 2 credit hours [SWS], 2+1 credit points [LP]
• Wetland ecology (laboratory course + excursion), 3 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 105 h
Private study: 165 h
Sum: 270 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
further courses in the area of ecology / ecosystem dynamics, theses in the Institute for Systematic Botany and Ecology
### Basic Statistics for Biologists

**Modules referring to Biodiversity/Ecology**

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<td>Language of instruction</td>
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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>PD Dr. Marco Tschapka</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Markus Metz, Dr. Swen Renner, PD Dr. Jutta Schmid</td>
</tr>
</tbody>
</table>

#### Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

#### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge on principles of data collection and data analysis.

#### Learning objectives

Students who have successfully completed this module
- have basic knowledge in statistics.
- are capable to operate the statistics package R, using the graphic user interface *R commander*.
- know how to collect and organize data and perform data analysis.

#### Syllabus

This module covers the following subject-specific topics:
- Theoretical and practical knowledge on performing basic statistic tests (simple tests, multivariate statistics)
- Exercises, using the software package R

#### Literature

- R script
- Sachs, Angewandte Statistik (2002)
- Sokal und Rohlf, Biometry (1981)
<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>Statistics (lecture/exercise), 2 credit hours [SWS], 3 credit points [LP]</th>
</tr>
</thead>
</table>
| Workload                      | Attendance time: 30 h  
                              | Private study: 60 h  
                              | Sum: 90 h |
| Assessment                    | Terminal written exam |
| Grading procedure             | No grades; exam must be passed by >50% |
| Basis for                     | Modules in the special subject Biodiversity and Ecology |
### Excursion
Modules referring to Biodiversity/Ecology

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<td><strong>Attendance time</strong></td>
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</tr>
<tr>
<td><strong>Language of instruction</strong></td>
<td>English, German</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Summer Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Dr. Philipp von Wrangell</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Lecturers from the faculty of biology</td>
</tr>
</tbody>
</table>

| **Allocation of study programmes** | Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester |

| **Recommended prerequisites** | Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None. |

<table>
<thead>
<tr>
<th><strong>Learning objectives</strong></th>
<th>Students who have successfully completed this module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• learned the characteristics of flora and fauna of exemplary ecosystems.</td>
</tr>
<tr>
<td></td>
<td>• have knowledge about ecological relations, interactions between organisms, interactions between organisms and their biotic and abiotic environment</td>
</tr>
<tr>
<td></td>
<td>• have knowledge about the human influence on ecosystems and their stability exemplified on natural or close to nature systems but also on typical cultural landscape systems.</td>
</tr>
<tr>
<td></td>
<td>• learned (depending on the excursions destination) methods of landscape management and environment protection.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Syllabus</strong></th>
<th>This module covers the following subject-specific topics:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Knowledge of flora and fauna</td>
</tr>
<tr>
<td></td>
<td>• Understanding of ecosystematic relations</td>
</tr>
<tr>
<td></td>
<td>• Influence of humans on ecosystems</td>
</tr>
<tr>
<td></td>
<td>• Landscape management (where applicable)</td>
</tr>
<tr>
<td></td>
<td>• Methods of environment protection (where applicable)</td>
</tr>
<tr>
<td>Literature</td>
<td>Depending on the excursion destination</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Teaching and learning methods</td>
<td>Compulsory elective Excursion [Wahlpflicht Exkursion] (excursion), 3 credit hours [SWS], 3 credit points [LP]</td>
</tr>
</tbody>
</table>
| Workload                           | Attendance time: 45 h  
Private study: 45 h  
Sum: 90 h |
<p>| Assessment                         | Successful participation               |
| Grading procedure                  | Ungraded                               |
| Basis for                          | -                                      |</p>
<table>
<thead>
<tr>
<th><strong>Tropical Conservation I - Universidad de Costa Rica - ungraded</strong></th>
<th></th>
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<tbody>
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<td><strong>Language of instruction</strong></td>
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<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
<tr>
<td><strong>Allocation of study programmes</strong></td>
<td>The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University: Excursion, Basic Statistics for Biologists, Additional module</td>
</tr>
<tr>
<td><strong>Recommended prerequisites</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
</tr>
<tr>
<td><strong>Learning objectives</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
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<tr>
<td><strong>Syllabus</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
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<tr>
<td><strong>Literature</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
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<tr>
<td><strong>Teaching and learning methods</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
</tr>
<tr>
<td><strong>Workload</strong></td>
<td>see module description of the Universidad de Costa Rica.</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>No english version available.</td>
</tr>
</tbody>
</table>
Grading procedure  No english version available.

Basis for  -
Tropical Botany I - Universidad de Costa Rica - ungraded
Modules referring to Biodiversity/Ecology

Code 8802673913

ECTS credits 3

Attendance time 2

Language of instruction Spanish

Duration 1 Semester

Cycle each Winter Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Excursion, Basic Statistics for Biologists, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
<table>
<thead>
<tr>
<th><strong>Tropical Ecology I - Universidad de Costa Rica - ungraded</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Modules referring to Biodiversity/Ecology</td>
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</table>

<table>
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<th><strong>Code</strong></th>
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<td><strong>Attendance time</strong></td>
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<tr>
<td><strong>Language of instruction</strong></td>
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</tr>
<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion
- Basic Statistics for Biologists
- Additional module

**Recommended prerequisites**

see module description of the Universidad de Costa Rica.

**Learning objectives**

see module description of the Universidad de Costa Rica.

**Syllabus**

see module description of the Universidad de Costa Rica.

**Literature**

see module description of the Universidad de Costa Rica.

**Teaching and learning methods**

see module description of the Universidad de Costa Rica.

**Workload**

see module description of the Universidad de Costa Rica.

**Assessment**

No english version available.
Grading procedure  No english version available.

Basis for  -
Tropical Zoology I - Universidad de Costa Rica - ungraded
Modules referring to Biodiversity/Ecology

Code 8802673914

ECTS credits 3

Attendance time 2

Language of instruction Spanish

Duration 1 Semester

Cycle each Winter Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Excursion, Basic Statistics for Biologists, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
**Microbiology - Master**  
Modules referring to Molecular Biosciences - Compulsory Electives

<table>
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<th><strong>Code</strong></th>
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<tbody>
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<td><strong>ECTS credits</strong></td>
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<tr>
<td><strong>Attendance time</strong></td>
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<td><strong>Language of instruction</strong></td>
<td>English, German</td>
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<tr>
<td><strong>Duration</strong></td>
<td>2 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Bernhard Eikmanns</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel</td>
</tr>
</tbody>
</table>

### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) to 2\(^{nd}\) study semester recommended;  
- Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) to 2\(^{nd}\) study semester recommended

### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
- Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).

### Learning objectives
- Students who have successfully completed this module  
  - have extended knowledge on key topics in microbiology and molecular microbiology.  
  - have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.  
  - have gathered experience in actively discussing scientific presentations  
  - have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.  
  - are able to individually work under supervision on own topics related to current research.
This module covers the following subject-specific topics:

Lectures:

- Microbiology IV (Microbial Regulation):
  RNA: Structure and function: (Ribosomal RNA {rRNA}; Transfer RNA {tRNA}; Messenger RNA {mRNA}; Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction {negative control}; Induction {positive control}; Repression {negative control}; Repression {positive control}; cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition!); Attenuation in Escherichia coli {amino acid biosynthesis}; Attenuation (antibiotic resistance induction); Attenuation (pyrimidine biosynthesis); Attenuation in Bacillus subtilis {amino acid biosynthesis}; Autogenic control; 2-Component systems {arc, ntr, che}; FNR-dependent regulation; Sigma factor-dependent regulation {heat shock, nitrogen metabolism, sporulation}; T-box-dependent regulation; Regulation by modification of tRNA bases; antisenseRNA-dependent regulation {plasmid replication, osmoregulation}; Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing {Vibrio harveyi, Staphylococcus aureus}; Regulation by rarely used tRNAs; Stringent response; Signal molecules)
  Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)
- Host-Microbe Interactions:
  Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

- Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense

Laboratory course (Microbiology Advanced Course):

- Principles and methods of enrichment, isolation and characterization of microorganisms (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogens; serological and enzymatic analysis of β-galactosidase in Escherichia coli; isolation and analysis of genes from Acinetobacter sp. and cloning of these genes; cultivation of Ashbya gossypii and analysis of substrate consumption and riboflavin formation by a mutant of this fungus; characterization of a key enzyme of riboflavin synthesis; growth, substrate consumption and glutamate production of Corynebacterium glutamicum; analysis of key enzymes of glutamate synthesis
- Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrecht); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment
Literature


• Ofek I, Hasty DI, Doyle RJ: *Bacterial Adhesion to Animal Cells and Tissues*, ASM Press, USA 2003


• Wilson M: *Bacteriology of Humans – An Ecological Perspective*, Blackwell Publishing USA 2008

Teaching and learning methods

• Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester

• Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester

• Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

Workload

Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment

Audited protocol, not graded; Successful participation at the seminar; not graded.

Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

Grading procedure

The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

Basis for

Master thesis in the Institute of Microbiology and Biotechnology
### Molecular Botany
Modules referring to Molecular Biosciences - Compulsory Electives

<table>
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<td><strong>Attendance time</strong></td>
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<tr>
<td><strong>Language of instruction</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
</tr>
<tr>
<td><strong>Coordinator</strong></td>
<td>apl. Prof. Dr. Stefan Binder</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka</td>
</tr>
</tbody>
</table>

#### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester recommended

#### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).

#### Learning objectives
- Students who have successfully completed this module
  - have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.
  - are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.
  - are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.
  - have expertise to judge and deliberate benefits and risks in green gene technology.

#### Syllabus
- This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

Literature
• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition

Teaching and learning methods
• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]
• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 255 h
Private study: 285 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of molecular botany
Endocrinology
Modules referring to Molecular Biosciences - Compulsory Electives

Code 8802670560

ECTS credits 18

Attendance time 16

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Jan Tuckermann

Instructor(s) Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Röszer, Dr. Sabine Vettorazzi

Allocation of study programmes
Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended;

Biology MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften].

Learning objectives Students who have successfully completed this module
- possess advanced knowledge about key issues in endocrinology and molecular endocrinology.
- have the ability for self-dependent preparation of a topic by original papers and to present it in a talk.
- are qualified for advanced practical work in a current research project in the area of molecular endocrinology.

Syllabus This module covers the following subject-specific topics:
- Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue.
• Practice of working techniques in cell biology, protein chemistry and molecular biology.
• Summarizations of results in a work record respectively a poster as well as an oral presentation.

<table>
<thead>
<tr>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Current textbooks about biochemistry as well as physiology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]</td>
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<td>• Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<td>• Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]</td>
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<th>Workload</th>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Nils Johnsson</td>
</tr>
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<td><strong>Instructor(s)</strong></td>
<td>Dr. Alexander Dünkler, Dr. Thomas Gronemeyer, Prof. Dr. Nils Johnsson</td>
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**Allocation of study programmes**
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 2\(^{nd}\) study semester recommended;
- Biology MSc, start of studies: winter semester, compulsory elective module, 2\(^{nd}\) study semester recommended

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in genetics and cell biology; e.g. module Developmental Biology and Genetics [Entwicklungsbiologie und Genetik] (BSc Biology), module Microbiology and Genetics [Mikrobiologie und Genetik] (BSc Biochemistry) or module Molecular Developmental Biology and Oncology [Molekulare Entwicklungsbiologie und Onkologie] (BSc Biochemistry).

**Learning objectives**
- Students who have successfully completed this module
  - have profound knowledge about the regulation of polarized growth and asymmetric cell division including the required theoretical background.
  - have knowledge of the required laboratory techniques to answer subject specific questions on the basis of experiments.
  - are capable of self-sustained preparation of a subject based on scientific literature and oral presentation including discussion.

**Syllabus**
This module covers the following subject-specific topics:
- Theoretical background covering the topics intracellular protein transport, protein secretion, cell division and the regulation of these events
- Hands-on application of genetic, cell biological and protein chemical techniques in the context of a current research project
- Oral presentation of the experimental results and preparation of a written report

<table>
<thead>
<tr>
<th>Literature</th>
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<tbody>
<tr>
<td>• Molecular Cell Biology. Lodish et al. Freeman 2008</td>
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<td>• Biochemistry. Voet &amp; Voet Wiley VCH 2011</td>
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<td>• Molecular Cell Biology (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<tr>
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### Conservation Genomics and Molecular Biology
**Modules referring to Molecular Biosciences - Compulsory Electives**

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# Protein Biochemistry

**Modules referring to Molecular Biosciences - Compulsory Electives**

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Marcus Fändrich</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others</td>
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**Allocation of study programmes**
- Biochemistry MSc, start of studies: winter semester, compulsory elective module;
- Biology MSc, start of studies: winter semester, compulsory elective module

**Recommended prerequisites**
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
- Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

**Learning objectives**
- Students who have successfully completed this module
  - have a broad overview on the structural properties of proteins,
  - know relevant techniques to structurally investigate proteins,
  - have insight in the most important protein-folding diseases,
  - are trained in planning scientific experiments themselves,
  - are trained in giving a scientific talk.

**Syllabus**
- This module covers the following subject-specific topics:
  - Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
  - Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
• Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer's
disease, Parkinson's disease, bovine spongiform encephalopathy (BSE),
scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA,
AL and ATTR amyloidosis, etc.

**Literature**
Will be announced in the courses

**Teaching and learning methods**
• Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Protein Biochemistry (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
Attendance time: 240 h
Private study: 300 h
Sum: 540 h

**Assessment**
Attested report, ungraded. Successful participation in the seminar, ungraded.
Written exam, graded.

**Grading procedure**
The grade is determined from the result of the exam.

**Basis for**
Master thesis in protein biochemistry.
Advanced Systematics
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802670565

ECTS credits 9

Attendance time 8

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Dieter Waloßek

Instructor(s) Dipl.Biol. Verena Kutschera, apl. Prof. Dr. Andreas Maas, Prof. Dr. Dieter Waloßek

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives Students who have successfully completed this module

• possess a deepened knowledge about Crustacea as an example of a species-rich and morphologically diverse taxon within the Arthropoda and Metazoa in general, about modern research approaches and methods, make use of modern thoughts about evolution and phylogeny.

• are capable to evaluate different theoretical explanatory models in the light of current research results on a specific animal taxon, which (a) represents the largest marine animal group with (b) sometimes extreme deviations from earlier ground patterns, is (c) known from more than half a Billion years old fossils and with since then diverging evolutionary lineages, but (d) is presented very mistakably in traditional teaching and text books.

• know about special scientific literature for own investigations, the development of small projects, writing of reports and about the application of different methods of and investigation and documentation to particular problems and animal material.

Syllabus This module covers the following subject-specific topics:
• External morphology of Crustacea and changes of ground-pattern conditions in the evolutionary lineage towards living representatives; specific focus is laid on the locomotory and feeding apparatus as important aspects in the life and evolution of animals. The two main taxa Entomostraca and Malacostraca are substantiated as monophyla.

• Examples of selected taxa to be investigated using various methods, including dissection, investigation and documentation, including scanning electron microscopy and modern light microscopy techniques. More aspects are the ontogeny (e.g., culture of developmental stages), material collection in the field and consideration of functional morphology.

• Theory and methods of phylogenetic systematics as a backbone and methodological approach to investigations of interrelationships of taxa.

**Literature**

- Own course guide with additional information to the studied objects, advice for sectioning and terminologies
- Handouts with additional information on the morphology and phylogeny of the relevant taxa
- Script of the lecture "Funktionsmorphologie der Tiere" [in German] from bachelor study
- Relevant literature on Crustacea and special scientific papers

**Teaching and learning methods**

- Morphology, Systematics and Phylogeny of Crustacea (lecture), 2 credit hours [SWS], 3 credits points [LP]
- Morphology, Systematics and Phylogeny of Crustacea (laboratory course), 6 credit hours [SWS], 9 credit points [LP]

**Workload**

- Attendance time: 120 h
- Private study: 150 h
- Sum: 270 h

**Assessment**

- Ungraded protocol with drawings and other documentaries, photographs, SEM micrographs, etc. Graded oral examination (or, if necessary, written examination).

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in biodiversity / zoological systematics
### Chemical Ecology

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Manfred Ayasse</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomaschko</td>
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**Allocation of study programmes**

Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

**Learning objectives**

Students who have successfully completed this module

- have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.
- can apply modern methods used in chemical ecology and behavioral ecology.
- have basic knowledge on the biology and ecology of social insects.

**Syllabus**

This module covers the following subject-specific topics:

**Lecture/seminar:**

- Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (alleles), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.
- In-depth information about the biology of social insects.
- Oral presentation and summarization of relevant scientific papers.

**Laboratory course:**

...
• Experiments on behavioral ecology and sociobiology of insects.
• Application of important methods used in chemical ecology.
• Apart from the specific content, basic methods used in scientific writing are taught as well.

**Literature**

• Harborne JB: Ökologische Biochemie. Spektrum Verlag, neueste Auflage.
• Further literature is presented during the course.

**Teaching and learning methods**

• Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
• Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

**Workload**

Attendance: 120 h
Private study: 150 h
Sum: 270 h

**Assessment**

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the area of chemical ecology
**Evolutionary Ecology: Interactions of Organisms**  
Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for

No english version available yet.
## Conservation Genomics
Modules referring to Biodiversity/Ecology - Compulsory Electives

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Simone Sommer</td>
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<tr>
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<td>Prof. Dr. Simone Sommer, Dr. Pablo Santos, Dr. Sebastian Menke</td>
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<td>Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie]. But also possible: Molecular Biology / Microbiology</td>
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| Learning objectives | Students who have successfully completed this module  
  - have basic knowledge about the principles and concepts of population and conservation genetics that influence genetic diversity and wildlife health  
  - have a good overview on the methods currently used to assess genetic diversity, as well as their advantages and limitations  
  - understand the functional importance of immune gene variability (MHC) in life history decisions (mate choice), evolutionary ecology (parasite and pathogen resistance) and conservation (population health)  
  - have a good overview on what drives gut bacterial diversity (microbiome) as well as associated health effects in wildlife species  
  - can apply selected modern methods used in evolutionary genetics and conservation genomics  
  - are able to perform efficient data mining and are able to handle and process large amounts of genetic sequences |
| Syllabus      | Lecture/seminar: |

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Master of Science Biology  
Date printed: 14. Dezember 2017  
page 276 of 482
• Concepts in population and conservation genetics
• In-depth information on various genetic markers used in population and conservation genetics and possible applications
• Next generation sequencing technologies: overview, chances and caveats
• Basic knowledge of sequence databases, genome repositories and other online resources of genetic data for evolutionary biologists
• Introduction of the most important genetic software packages for data analysis
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:
• Primer design in non-model organisms, i.e. wildlife species
• Molecular lab work: genetic data generation to measure genetic diversity in an evolutionary and conservation context
• Basics in bioinformatic data processing with a focus on MHC and microbiome data
• Application of genetic software packages for data analyses (e.g. BLAST, alignments and assembly tools, building phylogenetic trees)
• Apart from the specific content, basic methods used in scientific writing are taught as well.

Literature
• Further literature will be presented during the course

Teaching and learning methods
• Conservation Genomics (lecture), 4 credit hours [SWS], 4 credit points [LP]
• Conservation Genomics (seminar), 2 credit hours [SWS], 2 credit points [LP]
• Conservation Genomics (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 120 h
Private study: 150 h
Sum: 270 h

Assessment
No english version available yet.

Grading procedure
No english version available yet.

Basis for
Master thesis in the area of conservation genomics and EcoHealth.
Tropical Conservation II - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673909

ECTS credits 9

Attendance time 8

Language of instruction Spanish

Duration 1 Semester

Cycle each Summer Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
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### Ecology of the Mediterranean

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Grading procedure</td>
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Basis for

No english version available.
# Ecology of Tropical Habitats

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Steven Jansen</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka</td>
</tr>
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</table>

## Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester recommended

## Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme.

Contentually: Module Biodiversity and Ecology.

## Learning objectives

Students who have successfully completed this module

- have general knowledge about the ecology of tropical ecosystems.
- are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.
- know selected groups of organisms and interactions occurring in tropical ecosystems.
- have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.
- are capable to verify and analyze observations and experimental results and to present these orally and in writing.

## Syllabus

This module covers the following subject-specific topics:

**Lecture:**

- Basic introduction to tropical ecosystems, incl. basics of climatology
- Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains
Overview on important taxa of tropical plants and animals
• Animal-plant interaction in the tropics
• Specific threats to tropical ecosystems

Seminar:
• Presentation and discussion of selected publications on tropical ecology

Laboratory course:
• Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
• Ecophysiology of tropical plants
• Behavioral ecology and social organization of tropical bats
• Application and development of techniques for measuring tropical diversity

Literature

Teaching and learning methods
• Tropical Ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 210 h
Private study: 330 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of ecology/biodiversity.
Soil and Water
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672161

ECTS credits 9

Attendance time 6

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Biology lecturers from following universities:
  • Ulm University (Ulm, Germany)
  • University of South Bohemia in Ceske Budejovice (Budweis, Czech Republic)
  • Aix-Marseille University (Marseille, France)
  • Estonian University of Life Sciences (Tartu, Estonia)

Allocation of study programmes
  • Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester
  • Biology MSc, start of studies: winter semester, optional module, 1st or 3rd study semester
  • Biology Teacher Training, compulsory elective module, 5th, 7th or 9th study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Students who have successfully completed this module
  • have knowledge and competence regarding interactions between soils, plants and soil organisms with special emphasis on soil processes and effects of drought and flooding on plants and soil organisms.
  • know the major risks of soil degradation.
  • are familiar with the link between soil functions and societal needs and expectations.
Syllabus

This module covers the following subject-specific topics:

- Soil science
- Ecology
- Plant sciences
- Zoology

Literature

- Lectures notes and practical course notes
- Scientific articles for the seminars

Teaching and learning methods

- Lectures, 2 credit hours [SWS], 3 credit points [LP]
- Seminars, 1 credit hours [SWS], 2 credit points [LP]
- Practical courses / excursions, 3 credit hours [SWS], 4 credit points [LP]

Workload

Attendance: 90 h
Private study: 180 h
Sum: 270 h

Assessment

Oral exam

Grading procedure

The exam grade is the module grade.

Basis for

Master thesis in the area of ecology/biodiversity
Field Ecology II
Modules referring to Biodiversity/Ecology - Compulsory Electives

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**Allocation of study programmes**
Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

**Learning objectives**
Students who have successfully completed this module

- have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
- have a broad overview on animals and plants in tropical rainforests.
- have first experience with field work in a tropical ecosystem.
- are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
- have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
- have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
- have obtained first experience with international scientific cooperation.

**Syllabus**
This module covers the following subject-specific topics:
• Tropical ecology, focusing on Costa Rican ecosystems
• Overview and practical experience with plants and animals of Central American rain forests
• Introduction to field work in the tropics (group projects and individual projects)
• Basics of scientific work, including literature studies
• Experimental design, statistical testing of hypotheses, write-up of results
• Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

**Literature**


**Teaching and learning methods**

• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

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**Assessment**

Oral presentation in the seminar, laboratory course reports, written exam

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
### Field Ecology III

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure
No english version available.

Basis for
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### Tropical Botany IV - Universidad de Costa Rica

*Modules referring to Biodiversity/Ecology - Compulsory Electives*

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| Allocation of study programmes | The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University: Field Ecology II, Additional module |

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Grading procedure  No english version available.

Basis for -
Tropical Ecology II - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673961

ECTS credits 9

Attendance time 8

Language of instruction Spanish

Duration 1 Semester

Cycle each Summer Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

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| **Recommended prerequisites**     | see module description of the Universidad de Costa Rica.                                                      |
| **Learning objectives**          | see module description of the Universidad de Costa Rica.                                                      |
| **Syllabus**                     | see module description of the Universidad de Costa Rica.                                                      |
| **Literature**                   | see module description of the Universidad de Costa Rica.                                                      |
| **Teaching and learning methods**| see module description of the Universidad de Costa Rica.                                                      |
| **Workload**                     | see module description of the Universidad de Costa Rica.                                                      |
| **Assessment**                   | No english version available.                                                                                  |

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*Master of Science Biology*  
*Date printed: 14. Dezember 2017*  
*Page 298 of 482*
Grading procedure  No english version available.

Basis for  -
### Tropical Zoology II - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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**Allocation of study programmes**

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

**Recommended prerequisites**

see module description of the Universidad de Costa Rica.

**Learning objectives**

see module description of the Universidad de Costa Rica.

**Syllabus**

see module description of the Universidad de Costa Rica.

**Literature**

see module description of the Universidad de Costa Rica.

**Teaching and learning methods**

see module description of the Universidad de Costa Rica.

**Workload**

see module description of the Universidad de Costa Rica.

**Assessment**

No english version available.
Grading procedure

No english version available.

Basis for

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Grading procedure  No english version available.

Basis for  -
Wetland Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672052

ECTS credits 9

Attendance time 7

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Jan Dickopp, Ph.D. Ing. Tomás Picek (primarily responsible), Dr. Martin Werth

Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester;
- Biology BSc, start of studies: winter semester, optional module, 1st, 3rd or 5th study semester;
- Biology Teacher Training, start of studies: winter semester, compulsory elective module, 1st, 3rd, 5th, 7th or 9th study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Ecology [Ökologie], 2nd study semester BSc.

Learning objectives
Students who have successfully completed this module
- possess general knowledge about wetland ecology.
- know concepts for anthropogenic use of wetlands.
- conducted student projects concerning wetland ecology from concept to report.
- have the ability to critically evaluate and present observations and experimental results.
- can prepare relevant literature for a time-limited talk.

Syllabus
This module covers the following subject-specific topics:
Lecture:
• General introduction to various wetland ecosystems
• Types of wetlands
• Hydrology and soils
• Adaptations of plants
• Biogeochemistry
• Moors, tropical wetlands, coast wetlands
• Anthropogenic use: Use and destruction of moors, rice fields, constructed wetlands
• Protection, renaturation and management of wetlands

Seminar:
• Presentation and discussion of selected publications from the topic area of wetland ecology

Laboratory course and excursions:
• Basics of scientific working, incl. literature search, data acquisition, statistical analysis, report writing
• Ecophysiology of wetland plants (gas exchange, nutrient balance)
• Anatomy of wetland plants (aerenchyma, hyaline cells, …)
• Gas transport by wetland plants
• Capture of chemical parameters in soil and water

Literature

Teaching and learning methods
• Wetland ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Wetland ecology (seminar), 2 credit hours [SWS], 2+1 credit points [LP]
• Wetland ecology (laboratory course + excursion), 3 credit hours [SWS], 3 credit points [LP]

Workload
Attendance: 105 h
Private study: 165 h
Sum: 270 h

Assessment
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Further courses in the area of ecology / ecosystem dynamics, theses in the Institute for Systematic Botany and Ecology
## Basic Statistics for Biologists

**Modules referring to Biodiversity/Ecology**

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<td>Coordinator</td>
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<td>Instructor(s)</td>
<td>Dr. Markus Metz, Dr. Swen Renner, PD Dr. Jutta Schmid</td>
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</table>

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 1st study semester recommended

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge on principles of data collection and data analysis.

### Learning objectives

Students who have successfully completed this module

- have basic knowledge in statistics.
- are capable to operate the statistics package R, using the graphic user interface `R commander`.
- know how to collect and organize data and perform data analysis.

### Syllabus

This module covers the following subject-specific topics:

- Theoretical and practical knowledge on performing basic statistic tests (simple tests, multivariate statistics)
- Exercises, using the software package R

### Literature

- R script
- Sachs, Angewandte Statistik (2002)
- Sokal und Rohlf, Biometry (1981)
<table>
<thead>
<tr>
<th><strong>Teaching and learning methods</strong></th>
<th>• Statistics (lecture/exercise), 2 credit hours [SWS], 3 credit points [LP]</th>
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<tbody>
<tr>
<td><strong>Workload</strong></td>
<td>Attendance time: 30 h</td>
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<tr>
<td></td>
<td>Private study: 60 h</td>
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<td></td>
<td>Sum: 90 h</td>
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<td><strong>Assessment</strong></td>
<td>Terminal written exam</td>
</tr>
<tr>
<td><strong>Grading procedure</strong></td>
<td>No grades; exam must be passed by &gt;50%</td>
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<tr>
<td><strong>Basis for</strong></td>
<td>Modules in the special subject Biodiversity and Ecology</td>
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### Excursion
Modules referring to Biodiversity/Ecology

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<td><strong>Attendance time</strong></td>
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<td><strong>Language of instruction</strong></td>
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<tr>
<td><strong>Duration</strong></td>
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<td><strong>Cycle</strong></td>
<td>each Summer Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Dr. Philipp von Wrangell</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Lecturers from the faculty of biology</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module

- learned the characteristics of flora and fauna of exemplary ecosystems.
- have knowledge about ecological relations, interactions between organisms, interactions between organisms and their biotic and abiotic environment.
- have knowledge about the human influence on ecosystems and their stability exemplified on natural or close to nature systems but also on typical cultural landscape systems.
- learned (depending on the excursions destination) methods of landscape management and environment protection.

**Syllabus**

This module covers the following subject-specific topics:

- Knowledge of flora and fauna
- Understanding of ecosystematic relations
- Influence of humans on ecosystems
- Landscape management (where applicable)
- Methods of environment protection (where applicable)
<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th>Depending on the excursion destination</th>
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</thead>
<tbody>
<tr>
<td><strong>Teaching and learning methods</strong></td>
<td>Compulsory elective Excursion [Wahlpflicht Exkursion] (excursion), 3 credit hours [SWS], 3 credit points [LP]</td>
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</table>
| **Workload**        | Attendance time: 45 h  
|                     | Private study: 45 h  
|                     | Sum: 90 h |
| **Assessment**      | Successful participation |
| **Grading procedure** | Ungraded |
| **Basis for**       | - |
**Tropical Conservation I - Universidad de Costa Rica - ungraded**

Modules referring to Biodiversity/Ecology

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<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Universidad de Costa Rica</td>
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<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
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</table>

**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion, Basic Statistics for Biologists, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Botany I - Universidad de Costa Rica - ungraded

Modules referring to Biodiversity/Ecology

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<td>Cycle</td>
<td>each Winter Semester</td>
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<td>Coordinator</td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
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</table>

#### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion
- Basic Statistics for Biologists
- Additional module

#### Recommended prerequisites
see module description of the Universidad de Costa Rica.

#### Learning objectives
see module description of the Universidad de Costa Rica.

#### Syllabus
see module description of the Universidad de Costa Rica.

#### Literature
see module description of the Universidad de Costa Rica.

#### Teaching and learning methods
see module description of the Universidad de Costa Rica.

#### Workload
see module description of the Universidad de Costa Rica.

#### Assessment
No english version available.
Grading procedure  No english version available.

Basis for -
Tropical Ecology I - Universidad de Costa Rica - ungraded
Modules referring to Biodiversity/Ecology

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<td>each Winter Semester</td>
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<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion, Basic Statistics for Biologists, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure
No english version available.

Basis for
-
**Tropical Zoology I - Universidad de Costa Rica - ungraded**

Modules referring to Biodiversity/Ecology

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<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
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**Allocation of study programmes**
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Excursion, Basic Statistics for Biologists, Additional module

**Recommended prerequisites**
see module description of the Universidad de Costa Rica.

**Learning objectives**
see module description of the Universidad de Costa Rica.

**Syllabus**
see module description of the Universidad de Costa Rica.

**Literature**
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**
see module description of the Universidad de Costa Rica.

**Workload**
see module description of the Universidad de Costa Rica.

**Assessment**
No english version available.
Grading procedure

No english version available.

Basis for

-
## Advanced Neurobiology

**Modules referring to Neurobiology - Compulsory Electives**

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<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended
- Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> study semester

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives

Students who have successfully completed this module

- have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
- have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
- are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

### Syllabus

This module covers the following subject-specific topics:
Lectures:

- Energetics and allometry of animal movement
- Properties of ion channels and their contribution to neuronal excitation
- Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
- Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

- Experimental und theoretical treatment of the above mentioned topics (selected examples)

**Literature**

- Specific literature for laboratory course and seminar topics

**Teaching and learning methods**

- Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**


**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of behavioral biology or neurobiology
## Behavioral Physiology

Modules referring to Neurobiology - Compulsory Electives

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<td>Cycle</td>
<td>each Summer Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
</tbody>
</table>

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended
- Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2nd study semester

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives

Students who have successfully completed this module

- know the elements and their function in neural control circuits, including efferent and behavioral control.
- have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
- are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
- have gained practical experience in handling laboratory animals.
- are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
- have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
## Syllabus
This module covers the following subject-specific topics:

**Lecture Behavioral Physiology:**
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

**Lab course and seminar Behavioral Physiology:**
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

## Literature
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

## Teaching and learning methods
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

## Workload
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

## Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

## Grading procedure
The grade of the module will be the grade of the exam.

## Basis for
Master thesis in the area of neurobiology or behavioral biology
Advanced Systematics
Modules referring to Biodiversity/Ecology - Compulsory Electives

**Code** 8802670565

**ECTS credits** 9

**Attendance time** 8

**Language of instruction** English

**Duration** 1 Semester

**Cycle** each Summer Semester

**Coordinator** Prof. Dr. Dieter Waloßek

**Instructor(s)** Dipl.Biol. Verena Kutschera, apl. Prof. Dr. Andreas Maas, Prof. Dr. Dieter Waloßek

**Allocation of study programmes** Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended

**Recommended prerequisites** Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

**Learning objectives** Students who have successfully completed this module

- possess a deepened knowledge about Crustacea as an example of a species-rich and morphologically diverse taxon within the Arthropoda and Metazoa in general, about modern research approaches and methods, make use of modern thoughts about evolution and phylogeny.
- are capable to evaluate different theoretical explanatory models in the light of current research results on a specific animal taxon, which (a) represents the largest marine animal group with (b) sometimes extreme deviations from earlier ground patterns, is (c) known from more than half a Billion years old fossils and with since then diverging evolutionary lineages, but (d) is presented very mistakably in traditional teaching and text books.
- know about special scientific literature for own investigations, the development of small projects, writing of reports and about the application of different methods of and investigation and documentation to particular problems and animal material.

**Syllabus** This module covers the following subject-specific topics:
• External morphology of Crustacea and changes of ground-pattern conditions in the evolutionary lineage towards living representatives; specific focus is laid on the locomotory and feeding apparatus as important aspects in the life and evolution of animals. The two main taxa Entomostraca and Malacostraca are substantiated as monophyla.
• Examples of selected taxa to be investigated using various methods, including dissection, investigation and documentation, including scanning electron microscopy and modern light microscopy techniques. More aspects are the ontogeny (e.g., culture of developmental stages), material collection in the field and consideration of functional morphology.
• Theory and methods of phylogenetic systematics as a backbone and methodological approach to investigations of interrelationships of taxa.

**Literature**

- Own course guide with additional information to the studied objects, advice for sectioning and terminologies
- Handouts with additional information on the morphology and phylogeny of the relevant taxa
- Script of the lecture "Funktionsmorphologie der Tiere" [in German] from bachelor study
- Relevant literature on Crustacea and special scientific papers

**Teaching and learning methods**

- Morphology, Systematics and Phylogeny of Crustacea (lecture), 2 credit hours [SWS], 3 credits points [LP]
- Morphology, Systematics and Phylogeny of Crustacea (laboratory course), 6 credit hours [SWS], 9 credit points [LP]

**Workload**

- Attendance time: 120 h
- Private study: 150 h
- Sum: 270 h

**Assessment**

- Ungraded protocol with drawings and other documentaries, photographs, SEM micrographs, etc. Graded oral examination (or, if necessary, written examination).

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in biodiversity / zoological systematics
Chemical Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>Duration</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Manfred Ayasse</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomaschko</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].</td>
</tr>
</tbody>
</table>
| Learning objectives | Students who have successfully completed this module  
  • have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.  
  • can apply modern methods used in chemical ecology and behavioral ecology.  
  • have basic knowledge on the biology and ecology of social insects. |
| Syllabus          | This module covers the following subject-specific topics:  
  Lecture/seminar:  
  • Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (allomones), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.  
  • In-depth information about the biology of social insects.  
  • Oral presentation and summarization of relevant scientific papers.  
  Laboratory course: |
- Experiments on behavioral ecology and sociobiology of insects.
- Application of important methods used in chemical ecology.
- Apart from the specific content, basic methods used in scientific writing are taught as well.

**Literature**
- Further literature is presented during the course.

**Teaching and learning methods**
- Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
- Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

**Workload**
- Attendance: 120 h
- Private study: 150 h
- Sum: 270 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the area of chemical ecology
Evolutionary Ecology: Interactions of Organisms
Modules referring to Biodiversity/Ecology - Compulsory Electives

<table>
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Assessment: The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure: The grade of the module will be the grade of the exam.
Basis for No english version available yet.
Conservation Genomics
Modules referring to Biodiversity/Ecology - Compulsory Electives

**Code** 8802673045

**ECTS credits** 12

**Attendance time** keine Angaben

**Language of instruction** English

**Duration** 1 Semester

**Cycle** each Winter Semester

**Coordinator** Prof. Dr. Simone Sommer

**Instructor(s)** Prof. Dr. Simone Sommer, Dr. Pablo Santos, Dr. Sebastian Menke

**Allocation of study programmes** Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester

**Recommended prerequisites** Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie]. But also possible: Molecular Biology / Microbiology

**Learning objectives** Students who have successfully completed this module

- have basic knowledge about the principles and concepts of population and conservation genetics that influence genetic diversity and wildlife health
- have a good overview on the methods currently used to assess genetic diversity, as well as their advantages and limitations
- understand the functional importance of immune gene variability (MHC) in life history decisions (mate choice), evolutionary ecology (parasite and pathogen resistance) and conservation (population health)
- have a good overview on what drives gut bacterial diversity (microbiome) as well as associated health effects in wildlife species
- can apply selected modern methods used in evolutionary genetics and conservation genomics
- are able to perform efficient data mining and are able to handle and process large amounts of genetic sequences

**Syllabus** Lecture/seminar:
• Concepts in population and conservation genetics
• In-depth information on various genetic markers used in population and conservation genetics and possible applications
• Next generation sequencing technologies: overview, chances and caveats
• Basic knowledge of sequence databases, genome repositories and other online resources of genetic data for evolutionary biologists
• Introduction of the most important genetic software packages for data analysis
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:

• Primer design in non-model organisms, i.e. wildlife species
• Molecular lab work: genetic data generation to measure genetic diversity in an evolutionary and conservation context
• Basics in bioinformatic data processing with a focus on MHC and microbiome data
• Application of genetic software packages for data analyses (e.g. BLAST, alignments and assembly tools, building phylogenetic trees)
• Apart from the specific content, basic methods used in scientific writing are taught as well.

Literature

• Further literature will be presented during the course

Teaching and learning methods

• Conservation Genomics (lecture), 4 credit hours [SWS], 4 credit points [LP]
• Conservation Genomics (seminar), 2 credit hours [SWS], 2 credit points [LP]
• Conservation Genomics (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload

Attendance: 120 h
Private study: 150 h
Sum: 270 h

Assessment

No english version available yet.

Grading procedure

No english version available yet.

Basis for

Master thesis in the area of conservation genomics and EcoHealth.
### Tropical Conservation II - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Conservation IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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#### Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

#### Recommended prerequisites

see module description of the Universidad de Costa Rica.

#### Learning objectives

see module description of the Universidad de Costa Rica.

#### Syllabus

see module description of the Universidad de Costa Rica.

#### Literature

see module description of the Universidad de Costa Rica.

#### Teaching and learning methods

see module description of the Universidad de Costa Rica.

#### Workload

see module description of the Universidad de Costa Rica.

#### Assessment

No english version available.
Grading procedure  No english version available.

Basis for  -
## Ecology of the Mediterranean

Modules referring to Biodiversity/Ecology - Compulsory Electives

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Basis for
No english version available.
Ecology of Tropical Habitats
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802674170

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Steven Jansen

Instructor(s) Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 3rd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme.

Contentually: Module Biodiversity and Ecology.

Learning objectives Students who have successfully completed this module

• have general knowledge about the ecology of tropical ecosystems.
• are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.
• know selected groups of organisms and interactions occurring in tropical ecosystems.
• have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.
• are capable to verify and analyze observations and experimental results and to present these orally and in writing.

Syllabus This module covers the following subject-specific topics:

Lecture:

• Basic introduction to tropical ecosystems, incl. basics of climatology
• Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains
• Overview on important taxa of tropical plants and animals
• Animal-plant interaction in the tropics
• Specific threats to tropical ecosystems

Seminar:
• Presentation and discussion of selected publications on tropical ecology

Laboratory course:
• Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
• Ecophysiology of tropical plants
• Behavioral ecology and social organization of tropical bats
• Application and development of techniques for measuring tropical diversity

### Literature

### Teaching and learning methods
- Tropical Ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

### Workload
- Attendance: 210 h
- Private study: 330 h
- Sum: 540 h

### Assessment
- The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

### Grading procedure
- The grade of the module will be the grade of the exam.

### Basis for
- Master thesis in the area of ecology/biodiversity.
# Soil and Water

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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<td>Prof. Dr. Marian Kazda</td>
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**Instructor(s)**
- Biology lecturers from following universities:
  - Ulm University (Ulm, Germany)
  - University of South Bohemia in Ceske Budejovice (Budweis, Czech Republic)
  - Aix-Marseille University (Marseille, France)
  - Estonian University of Life Sciences (Tartu, Estonia)

**Allocation of study programmes**
- Biology MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester
- Biology MSc, start of studies: winter semester, optional module, 1<sup>st</sup> or 3<sup>rd</sup> study semester
- Biology Teacher Training, compulsory elective module, 5<sup>th</sup>, 7<sup>th</sup> or 9<sup>th</sup> study semester

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**
Students who have successfully completed this module
- have knowledge and competence regarding interactions between soils, plants and soil organisms with special emphasis on soil processes and effects of drought and flooding on plants and soil organisms.
- know the major risks of soil degradation.
- are familiar with the link between soil functions and societal needs and expectations.
**Syllabus**

This module covers the following subject-specific topics:

- Soil science
- Ecology
- Plant sciences
- Zoology

**Literature**

- Lectures notes and practical course notes
- Scientific articles for the seminars

**Teaching and learning methods**

- Lectures, 2 credit hours [SWS], 3 credit points [LP]
- Seminars, 1 credit hours [SWS], 2 credit points [LP]
- Practical courses / excursions, 3 credit hours [SWS], 4 credit points [LP]

**Workload**

- Attendance: 90 h
- Private study: 180 h
- Sum: 270 h

**Assessment**

- Oral exam

**Grading procedure**

The exam grade is the module grade.

**Basis for**

Master thesis in the area of ecology/biodiversity
### Field Ecology II

Modules referring to Biodiversity/Ecology - Compulsory Electives

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<td>PD Dr. Marco Tschapka, Jun. Prof. Dr. Steven Jansen</td>
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**Allocation of study programmes**

Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm.

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

**Learning objectives**

Students who have successfully completed this module

- have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
- have a broad overview on animals and plants in tropical rainforests.
- have first experience with field work in a tropical ecosystem.
- are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
- have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
- have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
- have obtained first experience with international scientific cooperation.

**Syllabus**

This module covers the following subject-specific topics:
• Tropical ecology, focussing on Costa Rican ecosystems
• Overview and practical experience with plants and animals of Central American rain forests
• Introduction to field work in the tropics (group projects and individual projects)
• Basics of scientific work, including literature studies
• Experimental design, statistical testing of hypotheses, write-up of results
• Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

**Literature**


**Teaching and learning methods**

- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

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**Assessment**

- Oral presentation in the seminar, laboratory course reports, written exam

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
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Basis for

No english version available.
Tropical Botany II - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673951
ECTS credits 9
Attendance time 8
Language of instruction No english version available.
Duration 1 Semester
Cycle each Summer Semester
Coordinator Universidad de Costa Rica
Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.
Learning objectives see module description of the Universidad de Costa Rica.
Syllabus see module description of the Universidad de Costa Rica.
Literature see module description of the Universidad de Costa Rica.
Teaching and learning methods see module description of the Universidad de Costa Rica.
Workload see module description of the Universidad de Costa Rica.
Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
# Tropical Botany IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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## Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

## Recommended prerequisites

see module description of the Universidad de Costa Rica.

## Learning objectives

see module description of the Universidad de Costa Rica.

## Syllabus

see module description of the Universidad de Costa Rica.

## Literature

see module description of the Universidad de Costa Rica.

## Teaching and learning methods

see module description of the Universidad de Costa Rica.

## Workload

see module description of the Universidad de Costa Rica.

## Assessment

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Tropical Ecology II - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802673961

ECTS credits 9

Attendance time 8

Language of instruction Spanish

Duration 1 Semester

Cycle each Summer Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Ecology of the Mediterranean, Field Ecology III, Additional module

Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure  No english version available.

Basis for  -
### Tropical Ecology IV - Universidad de Costa Rica

Modules referring to Biodiversity/Ecology - Compulsory Electives

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#### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

Field Ecology II, Additional module

#### Recommended prerequisites
see module description of the Universidad de Costa Rica.

#### Learning objectives
see module description of the Universidad de Costa Rica.

#### Syllabus
see module description of the Universidad de Costa Rica.

#### Literature
see module description of the Universidad de Costa Rica.

#### Teaching and learning methods
see module description of the Universidad de Costa Rica.

#### Workload
see module description of the Universidad de Costa Rica.

#### Assessment
No english version available.
Grading procedure

No english version available.

Basis for

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# Tropical Zoology II - Universidad de Costa Rica

**Modules referring to Biodiversity/Ecology - Compulsory Electives**

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## Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of the Mediterranean
- Field Ecology III
- Additional module

## Recommended prerequisites
see module description of the Universidad de Costa Rica.

## Learning objectives
see module description of the Universidad de Costa Rica.

## Syllabus
see module description of the Universidad de Costa Rica.

## Literature
see module description of the Universidad de Costa Rica.

## Teaching and learning methods
see module description of the Universidad de Costa Rica.

## Workload
see module description of the Universidad de Costa Rica.

## Assessment
No english version available.
Grading procedure  No english version available.

Basis for  -
Tropical Zoology IV - Universidad de Costa Rica
Modules referring to Biodiversity/Ecology - Compulsory Electives

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Grading procedure  No english version available.

Basis for  -
Wetland Ecology
Modules referring to Biodiversity/Ecology - Compulsory Electives

Code 8802672052

ECTS credits 9

Attendance time 7

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Marian Kazda

Instructor(s) Jan Dickopp, Ph.D. Ing. Tomás Picek (primarily responsible), Dr. Martin Werth

Allocation of study programmes
Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} or 3\textsuperscript{rd} study semester;

Biology BSc, start of studies: winter semester, optional module, 1\textsuperscript{st}, 3\textsuperscript{rd} or 5\textsuperscript{th} study semester;

Biology Teacher Training, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st}, 3\textsuperscript{rd},5\textsuperscript{th}, 7\textsuperscript{th} or 9\textsuperscript{th} study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Module Ecology [Ökologie], 2\textsuperscript{nd} study semester BSc.

Learning objectives
Students who have successfully completed this module

• possess general knowledge about wetland ecology.
• know concepts for anthropogenic use of wetlands.
• conducted student projects concerning wetland ecology from concept to report.
• have the ability to critically evaluate and present observations and experimental results.
• can prepare relevant literature for a time-limited talk.

Syllabus
This module covers the following subject-specific topics:

Lecture:
• General introduction to various wetland ecosystems
• Types of wetlands
• Hydrology and soils
• Adaptations of plants
• Biogeochemistry
• Moors, tropical wetlands, coast wetlands
• Anthropogenic use: Use and destruction of moors, rice fields, constructed wetlands
• Protection, renaturation and management of wetlands

Seminar:
• Presentation and discussion of selected publications from the topic area of wetland ecology

Laboratory course and excursions:
• Basics of scientific working, incl. literature search, data acquisition, statistical analysis, report writing
• Ecophysiology of wetland plants (gas exchange, nutrient balance)
• Anatomy of wetland plants (aerenchyma, hyaline cells, …)
• Gas transport by wetland plants
• Capture of chemical parameters in soil and water

**Literature**

**Teaching and learning methods**
• Wetland ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Wetland ecology (seminar), 2 credit hours [SWS], 2+1 credit points [LP]
• Wetland ecology (laboratory course + excursion), 3 credit hours [SWS], 3 credit points [LP]

**Workload**
Attendance: 105 h  
Private study: 165 h  
Sum: 270 h

**Assessment**
The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Further courses in the area of ecology / ecosystem dynamics, theses in the Institute for Systematic Botany and Ecology
## Advanced Neurobiology

Modules referring to Special Subject

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<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
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### Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended
- Master Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 1st study semester

### Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: good knowledge in neurobiology and behavioral biology, e.g. bachelor program in animal physiology, neurobiology.

### Learning objectives
Students who have successfully completed this module
- have in-depth knowledge of the energetics and allometry of animal movement, the neural mechanisms of sensorimotor control in invertebrates and vertebrates, of ion channel function, modulation of neuronal activity, cellular plasticity.
- have conceptual and experimental experience in electrophysiological and neuroanatomical methods to functionally characterize neurons and neural systems, in studying learning and memory processes in insects (honey bees as model organism), and in-depth skills in the simulation of neuronal networks.
- are able to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including statistical methods.

### Syllabus
This module covers the following subject-specific topics:
Lectures:

- Energetics and allometry of animal movement
- Properties of ion channels and their contribution to neuronal excitation
- Cellular and neuronal mechanisms of motor and sensorimotor control networks in invertebrates and vertebrates
- Sensory representation in the nervous system

Lab course and seminar Special Neurobiology:

- Experimental und theoretical treatment of the above mentioned topics (selected examples)

Literature

- Specific literature for laboratory course and seminar topics

Teaching and learning methods

- Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

Workload

- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

Assessment


Grading procedure

- The grade of the module will be the grade of the exam.

Basis for

- Master thesis in the area of behavioral biology or neurobiology
# Microbiology - Master

Modules referring to Special Subject

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Bernhard Eikmanns</td>
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<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Peter Dürre, Prof. Dr. Bernhard Eikmanns, Dr. Christian Riedel</td>
</tr>
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<td>Allocation of study programmes</td>
<td>Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended; Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended</td>
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<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Modules Molecular Biology I and II for Biochemistry [Molekularbiologie I und II für Biochemiker] (Biochemistry BSc); modules Molecular Biology I, II and III [Molekularbiologie I, II und III] (Biology BSc).</td>
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</table>
| Learning objectives | Students who have successfully completed this module  
  - have extended knowledge on key topics in microbiology and molecular microbiology.  
  - have gained deeper insight into current research in molecular microbiology through recent original articles and have improved skills in presenting results of own research.  
  - have gathered experience in actively discussing scientific presentations  
  - have gained skills and competences in independent research in the area of microbiology with respect to special methods and to a potential future Master thesis.  
  - are able to individually work under supervision on own topics related to current research. |
This module covers the following subject-specific topics:

Lectures:

- **Microbiology IV (Microbial Regulation):**
  RNA: Structure and function: (Ribosomal RNA (rRNA); Transfer RNA (tRNA); Messenger RNA (mRNA); Small, noncoding RNAs; Catalytic activity of RNA; RNA editing)
  Transcription: (RNA polymerase; Promoter; Elongation of transcription; Termination of transcription; Antitermination)
  Translation: (Initiation of translation; Elongation of translation; Termination of translation; Biosynthesis of selenoproteins; A "universal" genetic code?; Retroviruses, RNA viruses)
  Bacterial regulatory mechanisms at level of RNA and DNA (at level of proteins not included): (Induction (negative control); Induction (positive control); Repression (negative control); Repression (positive control); cAMP-dependent catabolite repression in Gram-negative bacteria; cAMP-independent catabolite repression in enterobacteria; Catabolite repression in Gram-positive bacteria; Endproduct inhibition (not feedback inhibition!); Attenuation in *Escherichia coli* (amino acid biosynthesis); Attenuation (antibiotic resistance induction); Attenuation (pyrimidine biosynthesis); Attenuation in *Bacillus subtilis* (amino acid biosynthesis); Autogenic control; 2-Component systems (*arc, ntr, che*); FNR-dependent regulation; Sigma factor-dependent regulation (heat shock, nitrogen metabolism, sporulation); T-box-dependent regulation; Regulation by modification of tRNA bases; antisense RNA-dependent regulation (plasmid replication, osmoregulation); Retroregulation; Enhancer elements; DNA loop-dependent regulation; DNA topology-dependent regulation; DNA methylation-dependent regulation; mRNA stability-dependent regulation; Riboswitches; Quorum sensing (*Vibrio harveyi, Staphylococcus aureus*); Regulation by rarely used tRNAs; Stringent response; Signal molecules)
  Regulation of bacteriophage lambda: (Lytic cycle; Lysogeny; Switch from lysogeny to lytic cycle)

- **Host-Microbe Interactions:**
  Interactions of microorganisms with their hosts (adhesion, invasion, probiosis mutualism, parasitism, toxins, pathogenicity host defense, innate and adaptive immunity, resistance to host defense)

Seminar:

- Presentation and critical discussion of state-of-the-art original research publications in the area of host-microbe interactions, pathogenicity and host defense

Laboratory course (Microbiology Advanced Course):

- Principles and methods of enrichment, isolation and characterization of microorganisms (Lactic acid bacteria, Bifidobacteria, carboxidotrophic bacteria, aerobic spore-formers, Pseudomonas); Ames-test for identification of carcinogens; serological and enzymatic analysis of β-galactosidase in *Escherichia coli*; isolation and analysis of genes from *Acinetobacter* sp. and cloning of these genes; cultivation of *Ashbya gossypii* and analysis of substrate consumption and riboflavin formation by a mutant of this fungus; characterization of a key enzyme of riboflavin synthesis; growth, substrate consumption and glutamate production of *Corynebacterium glutamicum*; analysis of key enzymes of glutamate synthesis
- Organization of biosafety and health safety in laboratories; introduction to relevant laws and regulations (e.g., the German Biostoffverordnung and Gentechnikrecht); safety rules and preventive measures during work in laboratories (e.g., operating instructions); safe working and risk assessment
Literature


Teaching and learning methods

- Host-Microbe Interactions (lecture/seminar), 2 credit hours [SWS], 2 credit points [LP], winter semester
- Microbiology IV (Microbial Regulation) (lecture), 3 credit hours [SWS], 4 credit points [LP], summer semester
- Microbiology Advanced Course (laboratory course), 12 credit hours [SWS], 12 credit points [LP], summer semester

Workload

- Attendance: 255 h
- Private study: 285 h
- Sum: 540 h

Assessment

- Audited protocol, not graded; Successful participation at the seminar; not graded.
- Oral examination (30 min.) to Microbiology IV and Microbiology Advanced Course, marked; written examination to Host-Microbe Interactions.

Grading procedure

- The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.

Basis for

- Master thesis in the Institute of Microbiology and Biotechnology
Chemical Ecology  
Modules referring to Special Subject

Code 8802674168

ECTS credits 12

Attendance time keine Angaben

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Manfred Ayasse

Instructor(s) Prof. Dr. Manfred Ayasse, PD Dr. Karl-Heinz Tomaschko

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Module Biodiversity and Ecology [Biodiversität und Ökologie].

Learning objectives Students who have successfully completed this module

• have basic knowledge about the functions of chemical signals in interactions between different organisms and within groups of organisms.
• can apply modern methods used in chemical ecology and behavioral ecology.
• have basic knowledge on the biology and ecology of social insects.

Syllabus This module covers the following subject-specific topics:

Lecture/seminar:

• Most important basic knowledge of chemical ecology e.g. semiochemicals, poisons (allomones), kairomones, parasites, parasitoids, chemical mimicry, pigments and bioluminescence and biological pest control.
• In-depth information about the biology of social insects.
• Oral presentation and summarization of relevant scientific papers.

Laboratory course:
- Experiments on behavioral ecology and sociobiology of insects.
- Application of important methods used in chemical ecology.
- Apart from the specific content, basic methods used in scientific writing are taught as well.

**Literature**

- Harborne JB: Ökologische Biochemie. Spektrum Verlag, neueste Auflage
- Further literature is presented during the course.

**Teaching and learning methods**

- Chemical Ecology (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP]
- Chemical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

**Workload**

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**Assessment**

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the area of chemical ecology
**Molecular Botany**  
Modules referring to Special Subject

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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>apl. Prof. Dr. Stefan Binder</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>apl. Prof. Dr. Stefan Binder, Prof. Dr. Axel Brennicke, Prof. Dr. Anita Marchfelder, PD Dr. Mizuki Takenaka</td>
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**Allocation of study programmes**  
Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended;  
Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd study semester recommended

**Recommended prerequisites**  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Module Molecular Biosciences [Molekulare Biowissenschaften] (MSc).

**Learning objectives**  
Students who have successfully completed this module

- have a solid knowledge of modern analytical techniques in plant molecular biology and its use in practice.
- are capable to understand original and review papers in English and to critically assess their significance and importance with regard to the current state of the art.
- are capable to evaluate possibilities and limits of molecular approaches in botany, also with regard to applied developments in green gene technology.
- have expertise to judge and deliberate benefits and risks in green gene technology.

**Syllabus**  
This module covers the following subject-specific topics:
• Intensive studies of modern methods and instruments of molecular biology and their application to plants in current research projects theoretically as well as practically.
• Projects in small groups dealing with current, molecular genetic research from modern botany.
• Technologies in green gene technology.
• Presentation of relevant and current English original and review papers.
• Discussion of current examples of modern research in plant molecular biology, plant biotechnology and green gene technology.

**Literature**

• Heldt: Pflanzenbiochemie, 3. Auflage, Spektrum Verlag
• Schopfer/Brennicke: Pflanzenphysiologie, 7. Auflage, Spektrum Verlag
• Buchanan et al.: Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists, second edition

**Teaching and learning methods**

• Molecular Botany (laboratory course), 15 credit hours [SWS], 15 credit points [LP]
• Molecular Botany (seminar), 2 credit hours [SWS], 3 credit points [LP]

**Workload**

Attendance: 255 h  
Private study: 285 h  
Sum: 540 h

**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the area of molecular botany
<table>
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<td><strong>Duration</strong></td>
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<td><strong>Cycle</strong></td>
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**Basis for**  No english version available yet.
### Endocrinology

Modules referring to Special Subject

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Jan Tuckermann</td>
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<td>Instructor(s)</td>
<td>Prof. Dr. Jan Tuckermann, Prof. Dr. Maja Vujic Spasic, Dr. Ion Cirstea, Dr. Tamas Röszer, Dr. Sabine Vettorazzi</td>
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#### Allocation of study programmes
- Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended;  
- Biology MSc, start of studies: winter semester, compulsory elective module, 1<sup>st</sup> or 3<sup>rd</sup> study semester recommended

#### Recommended prerequisites
- Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
- Contentually: Module Molecular Bioscience [Molekulare Biowissenschaften].

#### Learning objectives
- Students who have successfully completed this module  
  - possess advanced knowledge about key issues in endocrinology and molecular endocrinology.  
  - have the ability for self-dependent preparation of a topic by original papers and to present it in a talk.  
  - are qualified for advanced practical work in a current research project in the area of molecular endocrinology.

#### Syllabus
- This module covers the following subject-specific topics:  
  - Theoretical basics about current research projects of molecular endocrinology, especially from the areas: signal transduction by nuclear receptors, hormonal control of iron homeostasis, signaling in RAS-MAPK developmental disorders as well as hormonal signals and macrophage activation in adipose tissue.
- Practice of working techniques in cell biology, protein chemistry and molecular biology.
- Summarizations of results in a work record respectively a poster as well as an oral presentation.

**Literature**

- Current textbooks about biochemistry as well as physiology

**Teaching and learning methods**

- Endocrinology [Endokrinologie] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Endocrinology [Endokrinologie] (laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

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**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Master thesis in the Institute of Comparative Molecular Endocrinology
### Ecology of the Mediterranean

Modules referring to Special Subject

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Basis for

No english version available.
**Ecology of Tropical Habitats**

Modules referring to Special Subject

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<tr>
<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Steven Jansen</td>
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<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Steven Jansen, PD Dr. Marco Tschapka</td>
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<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study programme. Contentually: Module Biodiversity and Ecology.</td>
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</table>
| Learning objectives | Students who have successfully completed this module  
  • have general knowledge about the ecology of tropical ecosystems.  
  • are familiar with main concepts explaining the origin and maintenance of tropical biodiversity.  
  • know selected groups of organisms and interactions occurring in tropical ecosystems.  
  • have conducted entire projects on selected topics from tropical ecology, starting from the conceptual design up to the final manuscript.  
  • are capable to verify and analyze observations and experimental results and to present these orally and in writing. |
| Syllabus | This module covers the following subject-specific topics:  
  Lecture:  
  • Basic introduction to tropical ecosystems, incl. basics of climatology  
  • Plant traits in rainforests, seasonally dry forests, deserts, mangroves, tropical mountains |
• Overview on important taxa of tropical plants and animals
• Animal-plant interaction in the tropics
• Specific threats to tropical ecosystems

Seminar:
• Presentation and discussion of selected publications on tropical ecology

Laboratory course:
• Basics of scientific techniques, incl. working with literature, data collection, statistical analysis, preparation of reports
• Ecophysiology of tropical plants
• Behavioral ecology and social organization of tropical bats
• Application and development of techniques for measuring tropical diversity

Literature

Teaching and learning methods
• Tropical Ecology (lecture), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (seminar), 2 credit hours [SWS], 3 credit points [LP]
• Tropical Ecology (laboratory course), 6 credit hours [SWS], 6 credit points [LP]

Workload
Attendance: 210 h
Private study: 330 h
Sum: 540 h

Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure
The grade of the module will be the grade of the exam.

Basis for
Master thesis in the area of ecology/biodiversity.
Protein Biochemistry
Modules referring to Special Subject

Code 8802672099

ECTS credits 18

Attendance time 16

Language of instruction English

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. Marcus Fändrich

Instructor(s) Prof. Dr. Marcus Fändrich, Dr. Christian Haupt and others

Allocation of study programmes Biochemistry MSc, start of studies: winter semester, compulsory elective module; Biology MSc, start of studies: winter semester, compulsory elective module

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Lecture Biochemie I and the practical training Biochemie III within the Bachelor Biochemistry.

Learning objectives Students who have successfully completed this module
• have a broad overview on the structural properties of proteins,
• know relevant techniques to structurally investigate proteins,
• have insight in the most important protein-folding diseases,
• are trained in planning scientific experiments themselves,
• are trained in giving a scientific talk.

Syllabus This module covers the following subject-specific topics:
• Functional chemistry of amino acids, protein modifications (posttranslational and in vitro), cross-linking, protein secondary and tertiary structure, protein folding, protein stability and solubility, protein misfolding and diseases, protein engineering, expression and purification, antibody biotechnology, pharmaceutical proteins
• Application of biophysical techniques in protein biochemistry, e.g. circular dichroism and infrared spectroscopy, cryo-electron microscopy and three dimensional reconstruction methods, computational visualization and analysis of protein structures.
Biochemistry, pathology and therapy of protein-folding diseases like Alzheimer’s disease, Parkinson’s disease, bovine spongiform encephalopathy (BSE), scrapie, Creutzfeldt-Jakob disease, amyotrophic lateral sclerosis, systemic AA, AL and ATTR amyloidosis, etc.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Will be announced in the courses</th>
</tr>
</thead>
</table>

| Teaching and learning methods | Protein Biochemistry (lecture), 2 credit hours [SWS], 3 credit points [LP]  
|                               | Protein Folding Diseases (seminar), 2 credit hours [SWS], 3 credit points [LP]  
|                               | Protein Biochemistry (laboratory course), 12 credit hours [SWS], 12 credit points [LP] |

| Workload | Attendance time: 240 h  
|          | Private study: 300 h  
|          | Sum: 540 h |

| Assessment | Attested report, ungraded. Successful participation in the seminar, ungraded. Written exam, graded. |

| Grading procedure | The grade is determined from the result of the exam. |

| Basis for | Master thesis in protein biochemistry. |
Field Ecology II
Modules referring to Special Subject

<table>
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<td>Cycle</td>
<td>Summer Semester every two Years</td>
</tr>
<tr>
<td>Coordinator</td>
<td>PD Dr. Marco Tschapka</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>PD Dr. Marco Tschapka, Jun. Prof. Dr. Steven Jansen</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**
Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended, block course with 3 weeks abroad laboratory course in Costa Rica, plus time for review in Ulm

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Completion of several basic modules of ecology, e.g., Tropical Ecology [Tropenökologie], solid knowledge on topics of biodiversity.

**Learning objectives**
Students who have successfully completed this module
- have general knowledge on the biodiversity of tropical ecosystems with a focus on lowland rainforests of Central America (Costa Rica), incl. understanding of the current problems through anthropogenic land use changes.
- have a broad overview on animals and plants in tropical rainforests.
- have first experience with field work in a tropical ecosystem.
- are capable to summarize the current knowledge on selected topics of tropical ecology and present this to the other course participants.
- have conducted scientific projects on topics from tropical ecology in the field, starting from planning of the study to preparation of final manuscripts.
- have prepared together a course book that summarizes all observations and papers of the field course in Costa Rica.
- have obtained first experience with international scientific cooperation.

**Syllabus**
This module covers the following subject-specific topics:
• Tropical ecology, focussing on Costa Rican ecosystems
• Overview and practical experience with plants and animals of Central American rain forests
• Introduction to field work in the tropics (group projects and individual projects)
• Basics of scientific work, including literature studies
• Experimental design, statistical testing of hypotheses, write-up of results
• Tropical agricultural systems (e.g., banana, pineapple), incl. current conflicts between economy and ecology

**Literature**


**Teaching and learning methods**

- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (lecture), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Tropical Ecology in Costa Rica [Tropenökologie in Costa Rica] (field laboratory course), 12 credit hours [SWS], 12 credit points [LP]

**Workload**

- Attendance: 240 h
- Private study: 300 h
- Sum: 540 h

**Assessment**

- Oral presentation in the seminar, laboratory course reports, written exam

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Master thesis in the area of biodiversity and ecology, possibly about topics in tropical ecology abroad
## Tropical Ecology IV - Universidad de Costa Rica

Modules referring to Special Subject

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<td>Coordinator</td>
<td>Universidad de Costa Rica</td>
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<tr>
<td>Instructor(s)</td>
<td>Instructors of the Universidad de Costa Rica</td>
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### Allocation of study programmes
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Field Ecology II, Additional module

### Recommended prerequisites
see module description of the Universidad de Costa Rica.

### Learning objectives
see module description of the Universidad de Costa Rica.

### Syllabus
see module description of the Universidad de Costa Rica.

### Literature
see module description of the Universidad de Costa Rica.

### Teaching and learning methods
see module description of the Universidad de Costa Rica.

### Workload
see module description of the Universidad de Costa Rica.

### Assessment
No english version available.
Grading procedure    No english version available.

Basis for          -
Behavioral Physiology
Modules referring to Special Subject

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Wolfgang Mader, Dr. Andrea Wirmer, PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
</tr>
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Allocation of study programmes
- Biology MSc, start of studies: winter semester, compulsory elective module, 2\textsuperscript{nd} study semester recommended
- Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2\textsuperscript{nd} study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.

Learning objectives
Students who have successfully completed this module
- know the elements and their function in neural control circuits, including efferent and behavioral control.
- have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.
- are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.
- have gained practical experience in handling laboratory animals.
- are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.
- have gained competencies to carry out scientific experiments largely independently and to process and present data in structured oral presentations and posters, including good grasp of statistical methods.
**Syllabus**

This module covers the following subject-specific topics:

**Lecture Behavioral Physiology:**
- Behavior as systems property (cybernetic approach)
- Reflexes, pattern generation, command systems
- General orientation mechanisms, and in particular in bees, ants, and migratory birds
- Mechanisms that elicit and control instinctive behavior
- Interrelation between inherent and learned behavior
- Different forms of learning
- Introduction to Sociobiology
- Selected topics in Ethology (reproductive strategies, orientation behavior, animal communication)

**Lab course and seminar Behavioral Physiology:**
- Exemplary investigation of orienting: territorial, courtship, mating and parental behavior, learning behavior and communication in honey bees.

**Literature**
- Zupanc GKH: Behavioral Neurobiology, Oxford University Press, Oxford

**Teaching and learning methods**
- Behavioral Physiology (lecture), 4 credit hours [SWS], 6 credit points [LP]
- Behavioral Physiology (seminar), 2 credit hours [SWS], 3 credit points [LP]
- Behavioral Physiology (exercise), 12 credit hours [SWS], 12 credit points [LP]

**Workload**
- Attendance: 270 h
- Private study: 360 h
- Sum: 630 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
Master thesis in the area of neurobiology or behavioral biology
### Biochemistry Subsidiary Subject

**Modules referring to Biochemistry - Subsidiary Subject**

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<tr>
<td>Coordinator</td>
<td>Prof. Dr. Michael Kühl</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Assistants from the Institute of Biochemistry and Molecular Biology</td>
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</tbody>
</table>

**Allocation of study programmes**

Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) or 3\(^{rd}\) study semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge about biochemistry, molecular biology and developmental biology.

**Learning objectives**

Students who have successfully completed this module

- have knowledge about intracellular signal transduction.
- have knowledge about regulation of transcription factors.
- know the principles of organogenesis.
- know the basics of regeneration.

**Syllabus**

This module covers the following subject-specific topics:

- Growth factors
- Transcription factors
- Molecular basics of organogenesis and regeneration
- Model organisms of developmental biology and regeneration biology

**Literature**

- Alberts et al., Molecular Biology of the Cell, Garland Science
- Stryer, Biochemistry, Freeman
- Kühl und Gessert, Entwicklungsbiologie, UTB
### Teaching and learning methods

**Individual planning:**
- Laboratory Course [Praktikum], 12 credit hours [SWS], 12 credit points [LP]
- Seminar [Seminar], 2 credit hours [SWS], 3 credit points [LP]

### Workload

- Attendance: 210 h
- Private study: 240 h
- Sum: 450 h

### Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

### Grading procedure

The grade of the module will be the grade of the exam.

### Basis for

-
### Subsidiary Subject Biometry

Modules referring to Biometry - Subsidiary Subject

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Basis for

No english version available.
Human Genetics
Modules referring to Human Genetics - Subsidiary Subject

Code 8802671596

ECTS credits 15

Attendance time 12

Language of instruction German

Duration 2 Semester

Cycle each Winter Semester

Coordinator apl. Prof. Dr. Günter Assum

Instructor(s) apl. Prof. Dr. Günter Assum, Dr. Gotthold Barbi, apl. Prof. Dr. Josef Högel, apl. Prof. Dr. Hildegard Kehr-Sawatzki, Dr. Julia Bausinger, Dr. Rabea Wagener, Dr. Dana Simmet, Dr. Julia Vogt, Dr. Manuel Lüdeke

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 4\textsuperscript{th} study semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in human genetics as presented in introductory courses.

Learning objectives Students who have successfully completed this module

- have profound knowledge in various areas of classical and molecular human genetics.
- are able to familiarize themselves with different topics of human genetics in a self-dependent way.
- are able to work up the results of scientific work and to present them in posters or oral presentations.
- are able to plan and to perform basic experiments in the area of molecular genetics and to interpret the results.

Syllabus This module covers the following subject-specific topics:

Introduction to selected issues of human genetics at an advanced level

Discussion of recent scientific literature
Practical exercises dealing with:

- Identification of susceptibility genes for genetic disorders
- Cytogenetic and molecular genetic diagnostics
- Mutation screening
- Epigenetics

**Literature**

- Textbooks in Human Genetics, for example: "Human Molecular Genetics" from Tom Strachan and Andrew Read and "New Clinical Genetics" from Andrew Read and Dian Donnai.
- Review articles in various scientific journals.

**Teaching and learning methods**

- Molecular Human Genetics [Molekulare Humangenetik] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
- Human genetics for Biologists [Humangenetik für Biologen] (seminar), 2 credit hours [SWS], 3 credit points [LP], summer semester
- Mammalian and Human Genetics [Säugetier- und Humangenetik] (laboratory course), 8 credit hours [SWS], 9 credit points [LP], summer semester

**Workload**

- Attendance time: 180 h
- Private study: 270 h
- Sum: 450 h

**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

Continuative works in human genetics
Medical Neuroscience II
Modules referring to Medical Neuroscience - Subsidiary Subject

Code 8802670087

ECTS credits 15

Attendance time 14

Language of instruction English

Duration 1 Semester

Cycle each Winter Semester

Coordinator PD Dr. Petra Steinacker

Instructor(s) PD Dr. Petra Steinacker and further lecturers.

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 2nd study semester recommended

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Module 1 “Clinical Neurosciences - Basic and special lectures”

This module gives students theoretical insight into current knowledge about principle mechanisms common to neurological and in particular neurodegenerative human diseases. Specific contributing pathomechanisms, recently used therapeutical approaches, and areas of experimental neurology research in Ulm will be main issues.

The lecture block is followed by a written exam which is a prerequisite for the internship of module part 2.

After successful accomplishment of this module the students have knowledge about

• clinical classification of neurological/neurodegenerative diseases.
• basic mechanisms (e.g. excitotoxicity, oxidative and metabolic stress, failure of protein quality control, etc.) contributing to and specific pathophysiological mechanisms involved in the pathogenesis of neurological / neurodegenerative diseases including e.g. Alzheimer’s, Parkinson’s disease, Amyotrophic lateral sclerosis, genetic neurodegenerative diseases, and stroke.
Module part 2

Weekly Seminar “Neurological Diseases” (MEDex22), active participation starting from beginning of winter semester

“Clinical Neurosciences - Practical training” (registration necessary; maximum number of attendees 12)

This module gives students theoretical and practical insight into current methods used in neuroscience research in general and at the various research groups participating in the program in particular. Students will learn how these methods work in principle, what they are used for, what their potential is and what their limitations are. During the practical courses in our laboratories there will be hand on training in selected approaches of the neurobiological and behavioral sciences to study neural function in systems from basic molecular processes to the whole organism. Additionally demonstrations of complex approaches will be given. Opportunities for both basic and clinical research are included.

After successful accomplishment of this module the students have learned

• to interprete and presentate published data
• to plan own experiments
• to document own experimentally obtained data.
• to present own data in written form (“mini-paper”) and oral presentations.
• to discuss own results in the context of published data

Syllabus

Module 1 - Basic and special lectures:

In the winter semester (December) a 3-day block with 18 hours of lectures will teach the students basics of clinical neuroscience and current knowledge of disease characteristics and recent research on the pathological conditions of the most frequent neurological / neurodegenerative human diseases. Experimental approaches used in this field as biomarker discovery or transgenic animal research will complete the topics listed above. In the second half of January a written exam about the contents of the lecture series will take place.

Module 2 - Practical training:

For this module it is obligatory to pass the written exam mentioned above.

Each student has to complete 4 weeks practical courses in the labs of the neurology department (period: 01.02. – 31.03.). Depending on the lab the spectrum of matters reaches from cell culture / animal models of neurodegenerative diseases, diagnostic analysis of human body fluids, imaging, and behavioral examination. Students have to present their work in lab meetings and write a report about their internship project in form of a minipaper.

Literature

• Principles of Neural Science, Eric R. Kandel (new edition 2012)
• Additional literature will be provided in the beginning of the semester.

Teaching and learning methods

• From basic to clinical neuroscience (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
• Neurological Diseases (seminar), 1 credit hour [SWS], 2 credit points [LP], winter semester
• Clinical neurosciences part 2 - practical training (laboratory course), 11 credit hours [SWS], 10 credit points [LP], winter semester
<table>
<thead>
<tr>
<th><strong>Workload</strong></th>
<th>Attendance: 210 h</th>
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<tr>
<td></td>
<td>Private study: 240 h</td>
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<tr>
<td></td>
<td>Sum: 450 h</td>
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</table>

| **Assessment**     | Laboratory course report in the form of a mini-paper; oral exam |

| **Grading procedure** | Weighing: laboratory course report 1/2 and oral exam 1/2. |

| **Basis for**       | - |
# Pharmacology and Toxicology II - Master Biology and Biochemistry

Modules referring to Pharmacology and Toxicology - Subsidiary Subject

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<tr>
<td>Coordinator</td>
<td>PD Dr. Barbara Möpps, apl. Prof. Dr. Tatiana Syrovets</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. Holger Barth, Dr. Christina Förtsch, Prof. Dr. Peter Gierschik, Susanne Hafner, PD Dr. Barbara Möpps, Dr. Christoph Schmidt, Michael Schmiech, Prof. Dr. Thomas Simmet, apl. Prof. Dr. Tatiana Syrovets, Prof. Dr. Heike A. Wieland</td>
</tr>
</tbody>
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## Allocation of study programmes

Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) – 2\(^{nd}\) study semester;

Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) – 4\(^{th}\) study semester

## Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Lecture “Pharmacology and Toxicology” [Pharmakologie und Toxikologie I] (Bachelor).

## Learning objectives

Students who have successfully completed this module

- know the main features of drug development, may define pharmacologically relevant aspects of a medicament (e.g. pharmacokinetics, drug interactions, adverse effects...) and know about the characteristics of pharmacotherapy during special circumstances (e.g. old age or renal-/liver failure).
- may name pharmacotherapeutic options for treatment of important diseases as well as their pathogenetic and molecular basics.
- cope with the fundamentals in the subject toxicology.
- got to know the spectrum of experimental questions in the area of pharmacological/toxicological research and have the ability to develop own strategies for scientific handling of pharmacological/toxicological questions.
• are able to work independently and scientifically, i.e. to read up on a topic, to plan, conduct and analyze adequate experiments and to critically interpret, discuss and present own and published results.

Syllabus

The module is cooperatively offered by the Institute of Pharmacology and Toxicology (coordinator: PD Dr. Müllps) and the Institute of Naturopathy and Clinical Pharmacology (coordinator: apl. Prof. Dr. Syrovets). It extends over 2 semesters and contains 160 course hours which are composed as follows (all two-hour courses): 14 lecture dates “Pharmacology for Natural Scientists II” (winter semester), 14 lecture dates “Toxicology for Natural Scientists” (Prof. Dr. Barth), 2 seminars at 14 dates, respectively, and a one-week laboratory course (40 h) following the winter semester in the free period. The seminars and the laboratory course are offered by both involved institutes and may be selected. For the laboratory course the participants get divided in 6 groups, with 10 students maximum each. Each group passes a one-week laboratory course (see above). In case of less than 30 participants there is the opportunity to pass a two-week laboratory course (6 credit points [LP]).

This module covers the following subject-specific topics:

The lecture “Pharmacology” comprises the description of mechanisms of pharmaceutics for therapy on important diseases as well as corresponding anatomical and physiological basics:

• Drug development: safety of pharmaceutical products; pharmaceutical law & drug study; clinical studies; regulation of pharmaceutics
• Pharmacological properties of frequently applied pharmaceuticals: effects; indications, contraindications; pharmacokinetics; undesirable effects of pharmaceuticals; drug interactions
• Main features of pharmacokinetics
• Pharmacotherapy during special circumstances: pregnancy/lactation; childhood; old age; renal- and/or liver failure
• Therapy of cardiovascular diseases: coronary heart disease; chronic heart failure; hypertension; cardiac dysrhythmia
• Therapy of bronchopulmonary diseases: asthma; COPD
• Therapy of gastrointestinal diseases: gastroesophageal reflux disease; peptic ulcer; inflammatory bowel disease; diseases of the liver and bile duct; acute/chronic pancreatitis
• Therapy of endocrinal diseases: functional disorders of the thyroid gland; osteoporosis
• Therapy of metabolic disorders: diabetes mellitus; dyslipidemia
• Basics of antiinfectious therapy: bacterial infections; mycosis; viral infections; infections with protozoans
• Therapy of rheumatic disorders: rheumatoid arthritis
• Pain management: acute and chronic pains
• Therapy of neurological disorders: idiopathic parkinsonism; epilepsy; insomnia
• Pharmacotherapy of mental disorders: mood disorders; schizophrenia; anxiety disorders

The lecture “Toxicology” comprises:

• Regulatory toxicology (important safety values, REACH, chemical law)
• Cause and therapy of acute intoxications
• Toxins from animals, plants, fungi and bacteria
• Toxicology of the lung (gases, fibers, dust)
• Toxicology of metals
• Toxicology of pesticides
• Chemical cancer genesis
The spectrum of activities within the laboratory courses ("Pharmacology") covers separation processes of natural materials, investigations of molecular mechanisms of cellular signal transduction and clinical/pharmacological studies. Successful participation results in 3 credit points.

**Laboratory course “Toxicology”** gives training (a) to conduct investigations on mechanisms of bacterial toxins to cultivated mammalian cells and (b) on scientific documentation, analysis and interpretation of the results. Successful participation results in 3 credit points.

In **seminars of both departments** the students shall acquire and present molecular basics of pharmacotherapeutic research. Based on special diseases (e.g. HIV infection) or substance classes of pharmaceutics (e.g. antibiotics), pathogenically relevant mechanisms get described and various approaches of pharmacotherapeutic research get illustrated in the form of 30-45-minutes talks. Successful participation results in 3 credit points.

In the **seminar “Toxicology”** the students (a) acquire knowledge from literature about various current toxicological subjects such as toxicology of pharmaceutics, substances causing addiction, intoxicants, cancer genesis, toxicology of natural materials or toxicology of organs and (b) present it in the form of 20-minutes talks. Successful participation results in 3 credit points.

The **seminar “Development, Regulation and Monitoring of Medical Products”** communicates insights from pharmaceutical research by lecturers with applied knowledge. Successful participation results in 3 credit points.

---

**Literature**


---

**Teaching and learning methods**

Compulsory (two lectures, a total of 6 credit points [LP]):

- Pharmacology for Natural Scientists II [Pharmakologie für Naturwissenschaftler II] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
- Toxicology for Natural Scientists [Toxikologie für Naturwissenschaftler] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester

Elective (One laboratory course must be attended, 3 or 6 credit points [LP]):

- Laboratory Courses, Pharmacology and Toxicology as Subsidiary Subject [Laborpraktika, Pharmakologie und Toxikologie als Nebenfach] (laboratory course in one block), each with 2 credit hours [SWS] and 3 credit points [LP], summer semester (selectable)
  or Laboratory Courses, Pharmacology and Toxicology as Subsidiary Subject [Laborpraktika, Pharmakologie und Toxikologie als Nebenfach] (laboratory course in one block), each with 4 credit hours [SWS] and 6 credit points [LP], summer semester (selectable)
Elective (Two seminars must be attended, a total of 6 credit points [LP]):

- Seminars, Pharmacology and Toxicology as Subsidiary Subject [Seminare, Pharmakologie und Toxikologie als Nebenfach] (seminar), each with 2 credit hours [SWS] and 3 credit points [LP], winter+summer semester (selectable)

<table>
<thead>
<tr>
<th>Workload</th>
<th>Attendance: 160 h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Private study: 270 h</td>
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<tr>
<td></td>
<td>Sum: 430 h</td>
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</tbody>
</table>

| Assessment     | The module certificate is allocated by the responsible module coordinator for continuous and successful participation. Continuous participation is given if the student attended at least 85% of the courses. The passing of an exam (lectures: written form; seminars and laboratory courses: oral form) confirms the successful participation. |

| Grading procedure | The grade results from the overall and final oral exam at the end of the module. |

| Basis for       | - |
**Virology II**
Modules referring to Virology - Subsidiary Subject

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<thead>
<tr>
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<td>ECTS credits</td>
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<tr>
<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Jun.-Prof. Dr. Jens von Einem, Prof. Dr. Jan Münch</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Giada Frascaroli, Jun.-Prof. Dr. Daniel Sauter, Prof. Dr. Frank Kirchhoff, Prof. Dr. Thomas Mertens, Prof. Dr. Detlef Michel, Prof. Dr. Jan Münch, Prof. Dr. Reinhold Schirmbeck, Prof. Dr. Christian Sinzger, Jun.-Prof. Dr. Jens von Einem</td>
</tr>
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**Allocation of study programmes**
Biochemistry MSc, start of studies: winter semester, compulsory elective module, 1st to 3rd study semester;
Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester

**Recommended prerequisites**
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: Lecture General Virology for Natural Scientists [Allgemeine Virologie für Naturwissenschaftler] or knowledge of general principles of virology.

**Learning objectives**
Students who have successfully completed this module
- understand molecular mechanisms of virus entry, replication and egress.
- know the role of viruses in the transformation of cells and oncogenesis.
- understand the interaction of viruses with the immune system and viral immune evasion strategies.
- understand general aspects of vaccine development (targets, mechanisms, application).
- know the basics principles of diagnostic methods and their use.
- know the problem of emerging viruses.
- understand details of Influenza and HIV biology.
- are capable to work on and to present scientific topics with the help of actual literature.
Syllabus
This module covers the following subject-specific topics:

- Molecular mechanisms of virus host interactions
- Viral oncogenesis
- Viruses and the immune system
- Diagnosis, prevention, and treatment of viral diseases
- Vaccine development
- Emerging viruses
- Viral vectors and viral gene therapy

Literature
- Flint, Enquist, Racaniello, Skalka “Principles of Virology” 3rd Edition
- Current literature suggested by the lecturers

Teaching and learning methods
- Virology II (part 1) (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP], winter semester
- Virology II (part 2) (lecture/seminar), 2 credit hours [SWS], 3 credit points [LP], summer semester
- Virology (practical course) (laboratory course), 9 credit hours [SWS], 9 credit points [LP], summer semester

Workload
Attendance time: 195 h
Private study: 255 h
Sum: 450 h

Assessment
No english version available yet.

Grading procedure
No english version available yet.

Basis for
-
# Introductions to Bioinformatics

Modules referring to Bioinformatics and Systems Biology - Subsidiary Subject

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Basis for

No english version available yet.
Information and Systems Theory in Life Sciences
Modules referring to Bioinformatics and Systems Biology - Subsidiary Subject

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Basis for

No english version available yet.
### Chemistry

**Modules referring to Chemistry - Subsidiary Subject**

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<tr>
<td><strong>Cycle</strong></td>
<td>each Summer Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Prof. Dr. Gerhard Maas</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Dr. Christine Kranz, Prof. Dr. Gerhard Maas, Prof. Dr. Boris Mizaiikoff, Prof. Dr. Tanja Weil</td>
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<tr>
<td><strong>Allocation of study programmes</strong></td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1\textsuperscript{st} to 4\textsuperscript{th} study semester recommended</td>
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<tr>
<td><strong>Recommended prerequisites</strong></td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Chemistry modules from bachelor program.</td>
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</table>
| **Learning objectives** | Students who have successfully completed this module  
  • achieved a deep insight into a chemistry topic of their choice and acquired the corresponding knowledge, skills and competences. |
| **Syllabus**      | This module covers one of the following subject-specific topics (depending on the module part chosen):  
  • Bioanalytics  
  • Macromolecular chemistry  
  • Organic chemistry |
| **Literature**    | See online university calendar |
Teaching and learning methods

Topic in chemistry (It is compulsory to attend one of the three alternatives):

Option bioanalytics:

Lectures (compulsory):

- Instrumental Analytics [Instrumentelle Analytik] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester
- Bioanalytical Processing [Bioanalytische Verfahren] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester

Laboratory course (compulsory elective, one out of two):

- Advanced Laboratory Course of Instrumental Analytics [F-Praktikum Instrumentelle Analytik] (laboratory course), 6 credit hours [SWS], 6 credit points [LP], summer semester
- Laboratory course according to prior agreement [Laborpraktikum nach Absprache] (laboratory course), 6 credit hours [SWS], 6 credit points [LP], winter semester or summer semester

Contact person: Dr. Christine Kranz
Institute of Analytical and Bioanalytical Chemistry, O26 / 3

Option macromolecular chemistry:

Lecture (compulsory):

- Therapeutic Proteins [Therapeutische Proteine] (lecture / seminar), 1+1 credit hours [SWS], 3 credit points [LP], winter semester

Lecture (compulsory elective, one out of four):

- Biomaterials [Biomaterialien] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
- Biological Chemistry [Biologische Chemie] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester
- Biopolymers [Biopolymere] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester
- Chemistry of Natural Materials [Naturstoffchemie] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester

Laboratory course (compulsory elective, one out of two):

- Therapeutic Proteins [Therapeutische Proteine] (laboratory course / seminar), 6 credit hours [SWS], 6 credit points [LP], winter semester
- Laboratory course according to prior agreement [Laborpraktikum nach Absprache] (laboratory course), 6 credit hours [SWS], 6 credit points [LP], winter semester or summer semester

Contact person: Prof. Dr. Tanja Weil
Institute of Organic Chemistry III, O25 / 3

Option organic chemistry:

Lecture (compulsory):
• Chemistry of Natural Materials [Naturstoffchemie] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester

Lecture (compulsory elective, one out of five):

• Biomaterials [Biomaterialien] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
• Biological Chemistry [Biologische Chemie] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester
• Biopolymers [Biopolymere] (lecture), 2 credit hours [SWS], 3 credit points [LP], summer semester
• Non-aromatic Carbo- and Heterocycles [Nicht-aromatische Carbo- und Heterocyclen] (lecture), 2 credit hours [SWS], 3 credit points [LP], winter semester
• Therapeutic Proteins [Therapeutische Proteine] (lecture / seminar), 1+1 credit hours [SWS], 3 credit points [LP], winter semester

Laboratory course (compulsory):

• Special laboratory course in Organic Chemistry [Vertiefungspraktikum OC] (laboratory course / seminar), 6 credit hours [SWS], 6 credit points [LP], winter semester

Contact person: Prof. Dr. Gerhard Maas
Institute of Organic Chemistry I, O26 / 4

| Workload       | Attendance: 150 h  
|                | Private study: 210 h  
|                | Sum: 360 h  

| Assessment     | The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.  

| Grading procedure | The grade of the module will be the grade of the exam.  

| Basis for       | -  

# Introduction to Computer Science and Programming I and II

## Modules referring to Computer Science - Subsidiary Subject

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<td>Language of instruction</td>
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<td>Duration</td>
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<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Frank Slomka</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Axel Fürstberger, Dr. Klaus Murmann</td>
</tr>
</tbody>
</table>

### Allocation of study programmes

- Biology MSc, start of studies: winter semester, compulsory elective module, 1\(^{st}\) and 2\(^{nd}\) study semester;
- Mathematics BSc, start of studies: winter semester, compulsory module, 1\(^{st}\) and 2\(^{nd}\) study semester;
- Mathematics BSc, start of studies: summer semester, compulsory module, 2\(^{nd}\) and 3\(^{rd}\) study semester;
- Mathematical Economics BSc, start of studies: winter semester, compulsory module, 1\(^{st}\) and 2\(^{nd}\) study semester;
- Mathematical Economics BSc, start of studies: summer semester, compulsory module, 2\(^{nd}\) and 3\(^{rd}\) study semester;
- Physics BSc, 1\(^{st}\) – 3\(^{rd}\) semester;
- Econo-Physics BSc, 1\(^{st}\) – 3\(^{rd}\) semester;
- Electrical Engineering BSc, start of studies: winter semester, compulsory module, 3\(^{rd}\) and 4\(^{th}\) study semester;
- Mathematical Biometry, start of studies: winter semester, compulsory module, 1\(^{st}\) and 2\(^{nd}\) study semester

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

### Learning objectives

Students who have successfully completed this module
- know the fundamentals of formal languages and their definition.
• may practically handle computers, operating systems, service programs and tools.
• possess insight and intuition regarding the construction of algorithms by concrete examples.
• may evaluate algorithms by investigations of complexity.
• have the ability to systematically develop simple algorithms in a modern programming language and to transfer it into an executable program, know and understand data structures of higher complexity like trees or associative arrays concerning their definition (recursion) and application (recursive algorithms).
• may understand the principles of modern modeling techniques and apply them on the level of simple aspects.
• know classic as well as modern programming paradigms (e.g. recursion, abstract data types, inheritance, polymorphism, exception handling) and may apply them.

Syllabus

This module covers the following subject-specific topics:

• Introduction to the utilized operating system, dealing with useful commands and service programs plus practical handling of data files and processes
• Formal languages: definition and structuring
• Regular expressions, finite-state machines
• Algorithms and complexity
• Principles of system development and structuring
• Types of programming languages
• Standard data types, simply structured data types plus control structures of the selected programming language
• Development of simple algorithms for standard problems (e.g. searching, sorting)
• Structuring of software in large scale
• Complex data structures (e.g. lists, trees) and algorithms on top
• Modern concepts of programming languages like inheritance or polymorphism
• Aspects of reliability (e.g. exception handling)

Literature

• Knuth, D.: The Art of Computer Programming, Fundamental Algorithms; Addison-Wesley
• Wirth, N.: Algorithmen und Datenstrukturen; Teubner Verlag
• Lang, H.W.: Algorithmen und Datenstrukturen in Java; Oldenbourg
• Sedgewick, R.: Algorithmen in Java; Pearson Studium 2003

Teaching and learning methods

• General Computer Science I (GI 1) [Allgemeine Informatik I (AI 1)] (lecture), 2 credit hours [SWS], 4 credit points [LP], winter semester
• Exercises for General Computer Science I (GI 1) [Übungen zu Allgemeine Informatik I (AI 1)] (exercise), 1 credit hour [SWS], 2 credit points [LP], winter semester
• General Computer Science 2 (GI 1) [Allgemeine Informatik 2 (AI 2)] (lecture), 2 credit hours [SWS], 4 credit points [LP], summer semester
• Exercises for GI 2 [Übungen zu AI 2] (exercise), 1 credit hour [SWS], 2 credit points [LP], summer semester

Workload

Attendance: 90 h
Private study: 270 h
Sum: 360 h
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<th><strong>Assessment</strong></th>
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<tr>
<td><strong>Grading procedure</strong></td>
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<tr>
<td><strong>Basis for</strong></td>
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Applied Stochastics I
Modules referring to Mathematics - Subsidiary Subject

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<td>Duration</td>
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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Dr. Hartmut Lanzinger</td>
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<tr>
<td>Instructor(s)</td>
<td>Dr. Hartmut Lanzinger</td>
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Allocation of study programmes
Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester

Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: Basic knowledge in mathematics (school leaving examination level), mathematics module in bachelor course of studies.

Learning objectives
Students who have successfully completed this module

- know essential results and methods of statistics.
- are able to understand basic statistical techniques and methods

Syllabus
This module covers the following subject-specific topics:

- Elementary combinatorics, urn models
- Basics of probability, random variables, distributions
- Elementary statistics, expected value, variance, covariance
- Limit theorems, laws of large numbers
- Stochastic processes

Literature
not specified
| Teaching and learning methods | • Applied Stochastics I (lecture) [Angewandte Stochastik I], 2 credit hours [SWS], 2 credit points [LP], summer semester  
| • Applied Stochastics I (seminar) [Angewandte Stochastik I], 1 credit hour [SWS], 2 credit points [LP], summer semester  
| • Applied Stochastics I (exercise) [Angewandte Stochastik I], 1 credit hour [SWS], 2 credit points [LP], summer semester |
| Workload | Attendance: 60 h  
| Private study: 120 h  
| Sum: 180 h |
| Assessment | not specified |
| Grading procedure | not specified |
| Basis for | - |
Subsidiary Subject Mathematics for Master in Biology

Modules referring to Mathematics - Subsidiary Subject

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<tr>
<td>Coordinator</td>
<td>Dr. Hartmut Lanzinger, PD Dr. Benjamin Mayer</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Hartmut Lanzinger, Prof. Dr. Rainer Muche, PD Dr. Benjamin Mayer, Dr. Kathrin Hohl, Dr. Frank Fleicher, lecturers in Stochastics</td>
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<td>Allocation of study programmes</td>
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<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: Basic knowledge in mathematics (school leaving examination level), mathematics module in bachelor course of studies.</td>
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<td>Learning objectives</td>
<td>see the respective module descriptions of Applied Stochastics and Medical Statistics and Biometry.</td>
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<tr>
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<td>Literature</td>
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<td>Students have to take the courses of the modules Applied Stochastics I and Medical Statistics and Biometry. The order of the courses is irrelevant. Therefore, students can begin this module in summer semester or in winter semester.</td>
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| **Workload** | Attendance: 120 h  
Private study: 240 h  
Sum: 360 h |
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<td><strong>Grading procedure</strong></td>
<td>The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.</td>
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<tr>
<td><strong>Basis for</strong></td>
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## Medical Statistics and Biometrics

Modules referring to Mathematics - Subsidiary Subject

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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>PD Dr. Benjamin Mayer</td>
</tr>
</tbody>
</table>
| Instructor(s)      | MS: PD Dr. Benjamin Mayer, Dr. Kathrin Hohl  
                     CT: Prof. Dr. Rainer Muche, Dr. Frank Fleischer |
| Allocation of study programmes | Biology MSc, start of studies: winter semester, compulsory elective module, 1st to 4th study semester |
| Recommended prerequisites | Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually:  
MS: Basic knowledge in mathematics, mathematics module in bachelor course of studies, Basics of computer use.  
CT: Descriptive statistics |
| Learning objectives | Students who have successfully completed this module  
MS:  
• are capable of understanding the application of statistical methodology in scientific publications and assessing its validity.  
• have basic knowledge of the statistical software package R.  
CT:  
• have knowledge of fundamental steps in implementing and execution of clinical trials  
• have basic knowledge of regulatory guidelines for clinical trials |
**Syllabus**

This module covers the following subject-specific topics:

**MS:**

- Part 1 – Planning and conducting of clinical trials; underlying principles, types of trials in epidemiological and clinical research, important rules and standards for clinical trials
- Part 2 – Data analysis: descriptive statistics (univariate, bivariate, statistical indicators, use of graphics) correlation and regression, confidence intervals, statistical tests, characteristics of diagnostic tests, data analysis with the statistical software package R

**CT:**

- Planning and conducting of clinical trials
- Sample size estimation / Randomisation
- Regulatory guidelines for clinical trials
- Data management in clinical trials
- Reporting of clinical trials

**Literature**


**Teaching and learning methods**

In this module there is the option of choosing one of two courses:

- Medical Statistics and Biometry (V/Ü), 3 SWS, 6 LP, winter semester
- Clinical Trials (V/Ü), 3 SWS, 6 LP, summer semester (export subject Mathematics, not Molecular Medicine!)

Both courses are export subjects of the Faculty of Medicine and are conducted by the Institute for Epidemiology and Med. Biometry. In the module description the information for each course is indicated by **MS** for Medical Statistics and Biometry and **CT** for Clinical Trials.

**Workload**

Attendance: 60 h

Private study: 120 h

Sum: 180 h

**Assessment**

not specified

**Grading procedure**

not specified

**Basis for**

-
**Tropical Conservation III - Universidad de Costa Rica**  
Modules referring to Conservation - special subject

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<td><strong>Duration</strong></td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Winter Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Universidad de Costa Rica</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Instructors of the Universidad de Costa Rica</td>
</tr>
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</table>

**Allocation of study programmes**  
The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of tropical habitats
- Conservation Genomics
- Evolutionary Ecology: Interactions of Organisms
- Non-Biological Subsidiary Subject
- Additional module

**Recommended prerequisites**  
see module description of the Universidad de Costa Rica.

**Learning objectives**  
see module description of the Universidad de Costa Rica.

**Syllabus**  
see module description of the Universidad de Costa Rica.

**Literature**  
see module description of the Universidad de Costa Rica.

**Teaching and learning methods**  
see module description of the Universidad de Costa Rica.

**Workload**  
see module description of the Universidad de Costa Rica.

**Assessment**  
No english version available.
Grading procedure  No english version available.

Basis for  -
# Tropical Botany III - Universidad de Costa Rica

Modules referring to Conservation - special subject

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<td>Cycle</td>
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## Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:

- Ecology of tropical habitats
- Conservation Genomics
- Evolutionary Ecology: Interactions of Organisms
- Additional module

## Recommended prerequisites

see module description of the Universidad de Costa Rica.

## Learning objectives

see module description of the Universidad de Costa Rica.

## Syllabus

see module description of the Universidad de Costa Rica.

## Literature

see module description of the Universidad de Costa Rica.

## Teaching and learning methods

see module description of the Universidad de Costa Rica.

## Workload

see module description of the Universidad de Costa Rica.

## Assessment

No english version available.
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# Tropical Ecology III - Universidad de Costa Rica

Modules referring to Conservation - special subject

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<td><strong>Instructor(s)</strong></td>
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## Allocation of study programmes

The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:


## Recommended prerequisites

see module description of the Universidad de Costa Rica.

## Learning objectives

see module description of the Universidad de Costa Rica.

## Syllabus

see module description of the Universidad de Costa Rica.

## Literature

see module description of the Universidad de Costa Rica.

## Teaching and learning methods

see module description of the Universidad de Costa Rica.

## Workload

see module description of the Universidad de Costa Rica.

## Assessment

No english version available.
**Grading procedure**  No english version available.

**Basis for**  -
Tropical Zoology III - Universidad de Costa Rica
Modules referring to Conservation - special subject

Code 8802673957

ECTS credits 12

Attendance time keine Angaben

Language of instruction Spanish

Duration 1 Semester

Cycle each Winter Semester

Coordinator Universidad de Costa Rica

Instructor(s) Instructors of the Universidad de Costa Rica

Allocation of study programmes The module is offered by the Universidad de Costa Rica. Students who completed this module in the frame of the Costa Rica exchange, can impute it for the following modules at Ulm University:


Recommended prerequisites see module description of the Universidad de Costa Rica.

Learning objectives see module description of the Universidad de Costa Rica.

Syllabus see module description of the Universidad de Costa Rica.

Literature see module description of the Universidad de Costa Rica.

Teaching and learning methods see module description of the Universidad de Costa Rica.

Workload see module description of the Universidad de Costa Rica.

Assessment No english version available.
Grading procedure

No english version available.

Basis for

-
### Basics Philosophy A with 10 ECTS

Modules referring to Philosophy - Subsidiary Subject

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<td>Duration</td>
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<tr>
<td>Coordinator</td>
<td>Humboldt Study Center of the University of Ulm</td>
</tr>
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<td>Instructor(s)</td>
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<td>Recommended prerequisites</td>
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<td>Learning objectives</td>
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<td>Basic knowledge of epistemology and scientific theory (especially model and theory concept); basics of the general and applied ethics (specifically technology ethics); concept of evolution; basic knowledge of the philosophical eras; knowledge of exemplary historical action models; ability of the critical assessment of philosophical explanations.</td>
</tr>
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<td>Competences in contemplation and argumentation, transformation, research, linguistic competence, social competence, competence in moderation.</td>
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<td>Syllabus</td>
<td>Presentation and discussion of central positions or texts of the occidental philosophy, of the epistemology and scientific theory and of the general and applied ethics; as well as subject-dependent knowledge; Weighing up of different philosophic positions.</td>
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<td></td>
<td>• history of philosophy</td>
</tr>
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<td></td>
<td>• theoretical philosophy</td>
</tr>
<tr>
<td></td>
<td>• practical philosophy</td>
</tr>
<tr>
<td></td>
<td>• interdisciplinary seminars</td>
</tr>
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<td></td>
<td>• cultural anthropology</td>
</tr>
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<td>• old languages</td>
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Basics Philosophy A with 4 ECTS  
Modules referring to Philosophy - Subsidiary Subject

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<td><strong>Language of instruction</strong></td>
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<td><strong>Duration</strong></td>
<td>1 Semester</td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Semester</td>
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<td>Humboldt Study Center of the University of Ulm</td>
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<td><strong>Instructor(s)</strong></td>
<td>Lecturers of the Humboldt Study Center</td>
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<td><strong>Learning objectives</strong></td>
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<td>Basic knowledge of epistemology and scientific theory (especially model and theory concept); basics of the general and applied ethics (specifically technology ethics); concept of evolution; basic knowledge of the philosophical eras; knowledge of exemplary historical action models; ability of the critical assessment of philosophical explanations.</td>
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<td>Competences in contemplation and argumentation, transformation, research, linguistic competence, social competence, competence in moderation.</td>
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<td><strong>Syllabus</strong></td>
<td>Presentation and discussion of central positions or texts of the occidental philosophy, of the epistemology and scientific theory and of the general and applied ethics; as well as subject-dependent knowledge; Weighing up of different philosophic positions.</td>
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<tr>
<td><strong>Literature</strong></td>
<td>Will be announced by the respective lecturer at the beginning of the course.</td>
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</table>
Teaching and learning methods

Typically lectures and seminars with a total volume of 4 CP (presentation or written or oral exam)

Courses out of the following areas can be attended:

- history of philosophy
- theoretical philosophy
- practical philosophy
- interdisciplinary seminars
- cultural anthropology
- old languages

Workload

Presence Time: 45 h
Self Study: 75 h
Total: 120 h

Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.

Basis for

-
### Basics Philosophy A with 6 ECTS

*Modules referring to Philosophy - Subsidiary Subject*

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<td>Duration</td>
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<tr>
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<td>Lecturers of the Humboldt Study Center</td>
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<td>Literature</td>
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</table>
Teaching and learning methods

Typically Lectures and Seminars with a total volume of 6 CP (presentation and 10-to 12-sided seminar paper)

Courses out of the following areas can be attended:

- history of philosophy
- theoretical philosophy
- practical philosophy
- interdisciplinary seminars
- cultural anthropology
- old languages

Workload

Presence Time: 60 h
Self Study: 120 h
Total: 180 h

Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.

Basis for

-
# Basics Philosophy B with 4 ECTS

Modules referring to Philosophy - Subsidiary Subject

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<td>Lecturers of the Humboldt Study Center</td>
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Teaching and learning methods

Typically Lectures and Seminars with a total volume of 4 CP (presentation or written or oral exam)

Courses out of the following areas can be attended:

- history of philosophy
- theoretical philosophy
- practical philosophy
- interdisciplinary seminars
- cultural anthropology
- old languages

Workload

Presence Time: 45 h

Self Study: 75 h

Total: 120 h

Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.

Basis for

-
**Basics Philosophy B with 6 ECTS**

**Modules referring to Philosophy - Subsidiary Subject**

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<td>Instructor(s)</td>
<td>Lecturers of the Humboldt Study Center</td>
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**Allocation of study programmes**

All courses of studies with a subsidiary compulsory elective subject, semester at student's will

**Recommended prerequisites**

Formal prerequisites (according to Study order and examination regulations): none

Prerequisites regarding to the contents: none

**Learning objectives**

depends on the chosen course:
Basic knowledge of epistemology and scientific theory (especially model and theory concept); basics of the general and applied ethics (specifically technology ethics); concept of evolution; basic knowledge of the philosophical eras; knowledge of exemplary historical action models; ability of the critical assessment of philosophical explanations.

Competences in contemplation and argumentation, transformation, research, linguistic competence, social competence, competence in moderation.

**Syllabus**

Presentation and discussion of central positions or texts of the occidental philosophy, of the epistemology and scientific theory and of the general and applied ethics; as well as subject-dependent knowledge; weighing up of different philosophic positions.

**Literature**

Will be announced by the respective lecturer at the beginning of the course.
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<td>• interdisciplinary seminars</td>
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<td>• cultural anthropology</td>
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<td>• old languages</td>
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<td>The grade of the module will be the grade of the exam.</td>
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### Basics Philosophy C with 4 ECTS
Modules referring to Philosophy - Subsidiary Subject

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<td>Learning objectives</td>
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<td>Basic knowledge of epistemology and scientific theory (especially model and theory concept); basics of the general and applied ethics (specifically technology ethics); concept of evolution; basic knowledge of the philosophical eras; knowledge of exemplary historical action models; ability of the critical assessment of philosophical explanations.</td>
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<td>Syllabus</td>
<td>Presentation and discussion of central positions or texts of the occidental philosophy, of the epistemology and scientific theory and of the general and applied ethics; as well as subject-dependent knowledge; weighing up of different philosophic positions.</td>
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<td>Literature</td>
<td>Will be announced by the respective lecturer at the beginning of the course.</td>
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### Teaching and learning methods

Typically lectures and seminars with a total volume of 4 CP (presentation or written or oral exam)

Courses out of the following areas can be attended:

- history of philosophy
- theoretical philosophy
- practical philosophy
- interdisciplinary seminars
- cultural anthropology
- old languages

### Workload

Presence Time: 45 h

Self Study: 75 h

Total: 120 h

### Assessment

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

### Grading procedure

The grade of the module will be the grade of the exam.

### Basis for

-
### Compulsory Modules in Subsidiary Subject Psychology

Modules referring to Psychology - Subsidiary Subject

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<td><strong>Cycle</strong></td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>PD Dr. T. Stadnitski</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>PD Dr. T. Stadnitski and instructors of the Institute for Psychology and Education</td>
</tr>
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| **Allocation of study programmes** | Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\(^{st}\)-4\(^{th}\) semester |
| **Recommended prerequisites** | Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None. |
| **Learning objectives** | Students who have successfully completed this module are able to  
- give an overview of the study design, the range of topics in psychology and their coherence as well as the fundamental research methods.  
- name prominent questions in individual subjects and explain them in coherence  
- name, differentiate and illustrate the possibilities and limits of quantitative and qualitative methodological approaches in psychology as empirical science.  
- name and apply generally used statistical evaluation methods.  
- apply fundamental techniques of scientific work as well as learning strategies.  
- read scientific texts and conclusively summarize their content. |

| **Syllabus** | The lecture „Einführung in die Forschungsmethoden“ gives an overview of the scientific theory construction and the fundamental methods of psychological research (experiments, survey, observation). Further key issues of the research methods are random sampling, experimental design, quality criterions (internal and external validity, etc.) and an overview of statistical analysis models. |
**Literature**


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**Teaching and learning methods**

Lecture „Einführung in die Forschungsmethoden“ (2 SWS, 4 ECTS, Winter Semester)

---

**Workload**

Attendance: 30 h

Private study: 90 h

Sum: 120 h

---

**Assessment**

No english version available.

---

**Grading procedure**

No english version available.

---

**Basis for**

-
Testing Theory and Experimental Design
Modules referring to Psychology - Subsidiary Subject

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<tr>
<td>Instructor(s)</td>
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<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1st – 4th study semester</td>
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<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
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</table>
| Learning objectives | Students who have successfully completed this module
  • acquired fundamental knowledge about the topics of psychology as well as about the therein applied research methods.
  • acquired fundamental knowledge about psychology as an empirical science, especially the scope and constrains of quantitative and qualitative methods of approaches; and they understand generally used methods of statistical analysis.
  • may comprehend questions with regards to contents and methods in scientific articles and interpret empirical results. |
| Syllabus | This module covers the following subject-specific topics:
  • The lecture about research methods provides a review about die scientific formation of theories and the fundamental methods of psychological research (experiments, interview, observation). Further key aspects of research methods are: sampling procedure, design of experiments, quality criterions (intern and extern validity et cetera) and a review about statistical analysis models. |
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<thead>
<tr>
<th><strong>Literature</strong></th>
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<td>Testtheorie und Versuchsplanung, summer semester, 6 ECTS (incl. exercise and tutorial), exam 11586</td>
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### Differential Psychology

Modules referring to Psychology - Subsidiary Subject

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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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<tr>
<td>Coordinator</td>
<td>Prof. O. Wilhelm, Prof. C. Montag</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Institute for Psychology and Education and contract lecturers</td>
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**Allocation of study programmes**

Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None. However, basic knowledge in statistics is recommended for the understanding of the lecture.

**Learning objectives**

Students who have successfully completed this module are able to

- name, explain and critically scrutinize prominent constructs and methods of Differential Psychology.
- identify problems of differential psychological methods and to develop potential solutions.
- define, explain and differentiate biological, intrapsychical, dispositional, phenomenological, sociocultural, cognitive and adaptive paradigms and positions of Differential Psychology.
- name and explain achievement-based constructs of Differential Psychology.
- define and discuss validity and utility of differential psychological constructs.

**Syllabus**

The essential content of the module is the introduction of critical concepts and methods of the Differential Psychology. Besides a short review of currently significant differential psychological theories, core assumptions, methodological approaches, prototypical operationalization and essential problems of central constructs of Differential Psychology are being discussed. The validity and utility of differential psychological constructs is especially considered.
Lecture

- Theoretical concepts and empirical findings of Differential Psychology will be described in key topics.
- The relevance of this knowledge for resolving practical problems will be discussed.

Literature


Additional literature will be announced in the lecture.

Teaching and learning methods

Lecture „Differentielle Psychologie“ (2 SWS, 4 ECTS)

Workload

Attendance: 30 h
Private study: 90 h
Sum: 120 h

Assessment

No english version available yet.

Grading procedure

No english version available yet.

Basis for

-
Introduction to Psychology
Modules referring to Psychology - Subsidiary Subject

Code 8802670116
ECTS credits 4
Attendance time 2
Language of instruction German
Duration 1 Semester
Cycle each Winter Semester
Coordinator Dean of studies of the study programme B. Sc. Psychology
Instructor(s) Instructors of the Institute for Psychology and Education, invited guest lecturers and contract lecturers.

Allocation of study programmes
Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.
Contentually: None.

Learning objectives Students who have successfully completed this module are able to
• give an overview of the study design, the range of topics in psychology and their coherence as well as the fundamental research methods.
• name prominent questions in individual subjects and explain them in coherence
• name, differentiate and illustrate the possibilities and limits of quantitative and qualitative methodological approaches in psychology as empirical science.
• name and apply generally used statistical evaluation methods.
• apply fundamental techniques of scientific work as well as learning strategies.
• read scientific texts and conclusively summarize their content.

Syllabus In the introduction lecture, the essential topic areas of psychology are introduced by means of exemplary questions from the different topics. The historical development of the subject, the scientific theory construction as well as exemplary research paradigms and results are explained.

In the mentoring, the fundamental techniques of scientific work are developed in small groups (e.g. literature research, creation of seminar papers in accord
with the publication guidelines of the DGPs, structure and completion of a presentation). Further, helpful learning strategies for the exam preparation, the editing of texts etc. are introduced and trained.

|---------------------|---------------------------------------------------------------------------|

| Teaching and learning methods | Lecture „Einführung in die Psychologie“ (2 SWS, 2 ECTS) Mentoring (2 SWS, 2 ECTS, thereof 1 ECTS integrated key qualification, ISQ) |

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Clinical Psychology I - Bachelor
Modules referring to Psychology - Subsidiary Subject

Code 8802673816

ECTS credits 4

Attendance time 2

Language of instruction German

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. I.-T. Kolassa, Prof. O. Pollatos, Prof. H. Baumeister

Instructor(s) Lecturers of the Institute of Psychology and Education and if necessary assistant lecturers.

Allocation of study programmes Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None. Recommended are the following lectures: "Biologische Psychologie" (Module 73812), "Entwicklungspychologie" (Module 71108), "Allgemeine Psychologie I" (Module 73814), "Statistik" (I and II) (Module 71101).

Learning objectives General key competences:

- reading ability, judgement competences, text comprehension, problem-solving skill, argumentation skill, literature research, dealing with english scientific texts, presentation of scientific contents.

Clinical Psychology:

Psychological key competences:

- fundamental knowledge about mental disorders:
  - know and assess diagnostic methods
  - understand aetiological contexts
  - describe and assess different therapeutical approaches
  - deal with the basics of clinical psychological assessment
- reflect the clinical psychological view of the human being

Module specific competences:

- knowledge in epidemiology, diagnostics, differential diagnostics and classification of mental disorders
- knowledge of the aetiology of mental disorders
- explanation of biological correlates of mental disorders
- summary, interpretation and critical evaluation of current research results in the treatment of mental disorders
- recognition and reflection of the relations between theory, empirical research and application of psychological cognitions

Syllabus

Clinical Psychology

- Classification and diagnostics of mental disorders (DSM-IV and ICD-10)
- Fundamental concepts of the clinical psychology (e.g. aetiology, comorbidity, epidemiology, etc.)
- Paradigms of the clinical psychology (psychodynamic, behavioristic approach, behavioral therapy and cognitive behavioral therapy)
- Psychological interventions and Psychotherapy (fundamentals, neuropsychotherapy, client-centered psychotherapy, behavioral therapy and cognitive behavioral therapy, the diagnostic process)
- Affective disorders (symptoms, classification, epidemiology, diagnostics, aetiology, psychotherapy and/or pharmacotherapy, suicidality)
- Anxiety disorders (symptoms, classification, subtypes of the anxiety disorders, epidemiology, diagnostics, aetiology, psychotherapy and/or pharmacotherapy, suicidality)
- Obsessive-compulsive disorders (symptoms, classification, epidemiology, diagnostics, aetiology, psychotherapy and/or pharmacotherapy, suicidality)
- Personality disorders (general diagnostic criteria, cluster A, B, C, principal symptoms of the individual personality disorders)
- Addiction (Alcohol abuse and addiction, drug abuse and addiction: symptoms, classification, epidemiology, diagnostics, aetiology, psychotherapy and/or pharmacotherapy, suicidality)
- Somatic-Psychiatric Comorbidity, Psychodiabetology, Psychocardiology, Psychooncology, Psychological Pain Research
- Internet- and Mobile-based Interventions for mental disorders

Literature


Teaching and learning methods

Lecture „Klinische Psychologie I“ (2 SWS, 4 ECTS)

Workload

Attendance: 30 h
Private study: 90 h
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Sum: 120 h
Methods of Health Psychology
Modules referring to Psychology - Subsidiary Subject

Code 8802673866

ECTS credits 4

Attendance time 2

Language of instruction German

Duration 1 Semester

Cycle each Summer Semester

Coordinator Prof. Dr. O. Pollatos

Instructor(s) Prof. Dr. O. Pollatos

Allocation of study programmes Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\textsuperscript{st}-4\textsuperscript{th} semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Knowledge of health psychological aspects on the subject of diet, models of healthy dietary habits and sports, fundamentals of weight-related disorders as well as eating disorders, basic knowledge about different models of health behavior, stress, chronic diseases and pain, mediation of methods of health psychology.

Syllabus In this lecture, different fundamentals of health psychology shall be explained by means of current literature including current research. Emphasis is put on the mediation of basic knowledge about different methods in scientific context of health psychology. Besides a theoretical overview, relevant contents shall be intensified and explained in relation to practice. The fields diet, models of healthy dietary habits and sports are exemplarily explained. Further topics are different models of health behavior and aspects of stress and health.


Further literature will be announced in the lecture.

<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
<th>Vorlesung &quot;Methoden der Gesundheitspsychologie&quot; (2 SWS, 4 ECTS)</th>
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# Neuropsychology

Modules referring to Psychology - Subsidiary Subject

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<td>Prof. O. Pollatos, Prof. I.-T. Kolassa</td>
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<td>Instructor(s)</td>
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## Allocation of study programmes
Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

## Recommended prerequisites
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

## Learning objectives
Students who have successfully completed this module are able to

- describe, explain and distinguish neuropsychological disorder conditions including disorder-specific interventions and individual forms of therapy.
- apply diagnostic and therapeutic aspects on neuropsychological disorder conditions.
- discuss and classify the current state of research and praxis in the explanation, classification and treatment of neuropsychological disorders.
- name and explain different methods of research and diagnostic procedures.
- analyse and establish relations between theory, empirical research and application of psychological cognitions.

The students improve their key competences. This means they are able to

- argue conclusively.
- research and read English scientific texts, understand their contents and assess their quality.
- apply learning contents and discussed methods independently in practice.
- summarize and present scientific contents and texts.
- write scientific texts.
- implement learning contents practice-oriented.
• apply discussed methods independently.

**Syllabus**
The lecture shall mediate the fundamentals of the brain structure as well as the neuronal plasticity and besides knowledge about important neuropsychological disorder conditions like aphasia, executive disorders and dysexecutive syndrome, disorders of the sensors, of the voluntary motor function and the extrapyramidal systems, apraxia, disorders of the memory and forms of amnesia, dementia, agnosia and scotoma. A special emphasis lies on the classification of possible causes for neuropsychological disorders, i.a. infarcts, inflammatory brain diseases or traumatic brain injury with a focus on the expected outcome. Further, knowledge as well as the application of neuropsychological research and diagnostic methods shall be mediated. The focus here lies on disorders of the attention and the memory. Besides, case examples shall clarify and intensify the knowledge in a practice-oriented way.

**Literature**


**Teaching and learning methods**
Lecture “Neuropsychologie” (2 SWS, 4 ECTS)

**Workload**
Attendance: 30 h
Private study: 90 h
Sum: 120 h

**Assessment**
No english version available yet.

**Grading procedure**
No english version available yet.

**Basis for**
-
**Social Psychology I**  
Modules referring to Psychology - Subsidiary Subject

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</table>

**Allocation of study programmes**  
Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

**Recommended prerequisites**  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Command of English for reading and processing of the literature.

**Learning objectives**  
The students who successfully completed this module are able to:  
- name and describe the overall structure, the fundamental theoretical paradigms and the research logic of the modern social psychology.  
- recite, describe and delineate central topics of social psychology such as social cognition, social interaction and intra- and inter-group processes.  
- transfer social psychological theories to practical questions.  
- understand and illustrate empirical research findings as well as to classify and critically assess under methodological and und theoretical aspects.

**Syllabus**  
Classical and current theories and methods are introduced in this lecture. The central topics of social psychology are approached (social cognition, social interaction, intra- and inter-group processes) and the social psychological research methodology and research logic are introduced.

**Literature**  
The literature (mainly in English) will be announced in the lecture.
<table>
<thead>
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Social Psychology II  
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Allocation of study programmes  
Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\textsuperscript{st}-4\textsuperscript{th} semester

Recommended prerequisites  
Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: Command of English for reading and processing of the literature.

Learning objectives  
The students who successfully completed this module are able to:  
• name and describe the overall structure, the fundamental theoretical paradigms and the research logic of the modern social psychology.  
• recite, describe and delineate central topics of social psychology such as social cognition, social interaction and intra- und inter-group processes.  
• transfer social psychological theories to practical questions.  
• understand and illustrate empirical research findings as well as to classify and critically assess under methodological and und theoretical aspects.

Syllabus  
Classical and current theories and methods are introduced in this lecture. The central topics of social psychology are approached (social cognition, social interaction, intra- and inter-group processes) and the social psychological research methodology and research logic are introduced.

Literature  
The literature (mainly in English) will be announced in the lecture.
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<td>Prof. Dr. A. Huckauf</td>
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<tr>
<td><strong>Instructor(s)</strong></td>
<td>Prof. A. Huckauf, Prof. M. Kiefer, co-workers of the Department of General Psychology, contract lecturers</td>
</tr>
<tr>
<td><strong>Allocation of study programmes</strong></td>
<td>Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\textsuperscript{st}-4\textsuperscript{th} semester</td>
</tr>
<tr>
<td><strong>Recommended prerequisites</strong></td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
</tr>
<tr>
<td><strong>Learning objectives</strong></td>
<td>General key competences:</td>
</tr>
<tr>
<td></td>
<td>reading ability; judgement competences; text comprehension; problem-solving skill; argumentation skill; quantitative thinking; literature research; presentation techniques; facilitation and interaction in a team</td>
</tr>
<tr>
<td></td>
<td>Psychological key competences:</td>
</tr>
<tr>
<td></td>
<td>Recognition and reflexion of the relations between theory, empirical research and application of psychological cognitions. Critical appreciation of research results and methods. Dealing with scientific texts and differentiation between original and secondary literature.</td>
</tr>
<tr>
<td></td>
<td>Module specific competences:</td>
</tr>
<tr>
<td></td>
<td>The students gain fundamental knowledge in the theories, methods, topics and results of psychophysics, perceptual, attentional and consciousness research. They are able to define and differentiate the central theoretical constructs, to assess their scientific investigation in historical context and to comprehend current controversies. Further, they gain insight into the dealing with experimental</td>
</tr>
</tbody>
</table>
procedures as well as into overlapping sections and relations of the General Psychology with other branches of psychology (e.g. Differential Psychology, Developmental Psychology, Social Psychology, Biological Psychology).

| Syllabus | In „Allgemeine Psychologie I“ the topics history of psychology, psychophysics, perception, imagination, attention, consciousness, learning and memory are covered. Besides the introduction in historical aspects of the general psychology and psychophysics, central phenomena and concepts like sensory thresholds, signal detection, consistency performances, masking phenomena, after-effects, visual search, vigilance, sleeping, conditioning, phonological loop, visual-spatial storage and others are covered. For all topics there is an introduction in classical and current theories and methods as well as central paradigms and research works. |
| Literature | The lecture is based on selected chapters of relevant textbooks of cognition psychology that are introduced during the lecture. The literature is partly in English. |
| Teaching and learning methods | Lecture "Allgemeine Psychologie Ib" (2 SWS, 4 ECTS). Written exam "11953 Vorlesung Allgemeine Psychologie Ib" |
| Workload | Attendance: 60 h Private study: 60 h Sum: 120 h |
| Assessment | No english version available yet. |
| Grading procedure | No english version available yet. |
| Basis for | - |
General Psychology II, Lecture

Modules referring to Psychology - Subsidiary Subject

<table>
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<td>Attendance time</td>
<td>2</td>
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<tr>
<td>Language of instruction</td>
<td>German</td>
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<tr>
<td>Duration</td>
<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>irregular</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. A. Huckauf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Department of General Psychology, contract lecturers</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\textsuperscript{st}-4\textsuperscript{th} semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
</tr>
<tr>
<td>Learning objectives</td>
<td>The students gain knowledge about fundamental cognitive functions. Thereby they shall learn to know and understand the classical investigations and paradigms about individual subareas. Further, they shall be put in the position to critically assess research approaches of current research questions as well as to generate applications of the respective results and models.</td>
</tr>
<tr>
<td>Syllabus</td>
<td>Fundamental empirical results about cognitive functions of attention, the consciousness, the language and the motor function are introduced. The resulting theoretical assumptions are shown and undergone criticism.</td>
</tr>
<tr>
<td>Literature</td>
<td>The literature is mainly in English and will be announced at the beginning of the lecture.</td>
</tr>
<tr>
<td>Teaching and learning methods</td>
<td>Lecture &quot;Allgemeine Psychologie II&quot; (2 SWS, 4 LP). Written exam &quot;11964 Vorlesung Allgemeine Psychologie II&quot;. There may be an oral exam when there are only few participants.</td>
</tr>
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</table>
| **Workload** | Attendance: 30 h  
|             | Private study: 90 h  
|             | Sum: 120 h  |
| **Assessment** | No english version available yet.  |
| **Grading procedure** | No english version available yet.  |
| **Basis for** | -  |
**Lecture Biological Psychology**

Modules referring to Psychology - Subsidiary Subject

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<td>Language of instruction</td>
<td>German or English</td>
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<td>Duration</td>
<td>1 Semester</td>
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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. O. Pollatos, Prof. Dr. I.-T. Kolassa</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Instructors of the Institute for Psychology and Education and contract lecturers.</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**

Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester

**Recommended prerequisites**

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

**Learning objectives**

Students who have successfully completed this module are able to:

- name fundamental structures and functions of the nervous system, like e.g. nerve conduction and synaptic transmission.
- outline the development of the nervous system.
- name and explain the biological fundamentals of health, emotions and stress.
- name and describe the mechanisms of perception, consciousness, memory and learning, sleep and the sensomotoric system.
- name different brain damages and differentiate them by means of imaging methods.
- describe the biological processes of psychiatric disorders.
- define, differentiate and explain research methods of the biopsychology and health psychology as well as biopsychological domains relevant for psychic disorders.
- name, describe and critically evaluate methods and diagnostics of health psychology, module specific data collection (biomarkers, behavioral observation, questionnaire, interview), designs, analysis methods and evaluations.

The students improve their key competences. This means they are able to...
• argue conclusively.
• research and read English scientific texts, understand their contents and assess their quality.
• apply learning contents and discussed methods independently in practice.
• summarize and present scientific contents and texts.
• write scientific texts.

Syllabus
Fundamentals of the methods and diagnostics of the clinical and biological psychology as well as the health psychology.
In particular: anatomy of the nervous system; nerve conduction and synaptic transmission; research methods of biopsychology and neuroscience; visual system; acoustic system, mechanisms of perception, the consciousness and attention; sensomotoric system, development of the nervous system; brain damage and neuronal plasticity; learning, memory and amnesia; hunger, food and health; hormones and sexuality; sleep, dream and circadian rhythms, drug addiction and the reward centres of the brain, lateralisation, language and the split brain; biopsychology of emotions, stress and health; biopsychology of psychiatric disorders (psychopharmacology; endocrinology; immunology; genetics and epigenetics); psychoneuroimmunology.

Literature

Teaching and learning methods
Lecture "Biologische Psychologie" (2 SWS, 4 ECTS)

Workload
Attendance: 30 h
Private study: 90 h
Sum: 120 h

Assessment
No english version available yet.

Grading procedure
No english version available yet.

Basis for
-
# Lecture Developmental Psychology

Modules referring to Psychology - Subsidiary Subject

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<td>Language of instruction</td>
<td>German or English</td>
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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
<td>Prof. D. Zimprich</td>
</tr>
<tr>
<td>Instructor(s)</td>
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<td>Allocation of study programmes</td>
<td>Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1st-4th semester</td>
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<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
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</table>

## Learning objectives

Students who have successfully completed this module are able to

- define and explain basic terms of the developmental psychology.
- name, describe and critically evaluate theories, methods and empirical research results of the developmental psychology.
- name and differentiate phenomena of age-related changes and stabilities in the behavior and the experience, in learning and performance over the lifespan.
- explain empirical research results and classify and critically evaluate under theoretical and methodological aspects.
- relate developmental psychological theories to practical and applied questions.
- read scientific texts, explain their contents, classify and evaluate their quality and assess their relevance.
- summarize and classify scientific contents and texts, describe and present them in their own words.

## Syllabus

The module provides an overview of central theories of the developmental psychology and phenomena of age-related changes and stabilities in the behavior and the experience, in learning and performance over the lifespan. The students get to know essential research methods and empirical results of the topic.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Teaching and learning methods</td>
<td>Lecture „Entwicklungspsychologie“ (2 SWS, 4 ECTS)</td>
</tr>
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</table>
| Workload         | Attendance: 30 h  
|                  | Private study: 90 h  
|                  | Sum: 120 h |
| Assessment       | No english version available yet. |
| Grading procedure| No english version available yet. |
| Basis for        | - |
**Lecture General Psychology Ia**

Modules referring to Psychology - Subsidiary Subject

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<td>Duration</td>
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<td>Cycle</td>
<td>irregular</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. A. Huckauf</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. A. Huckauf, Prof. M. Kiefer, co-workers of the Department of General Psychology, contract lecturers</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology M.Sc., start of studies: winter semester, compulsory elective module in the subsidiary subject Psychology, 1\textsuperscript{st}-4\textsuperscript{th} semester</td>
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<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
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</table>

**Learning objectives**

- **General key competences:**
  - reading ability; judgement competences; text comprehension; problem-solving skill; argumentation skill; quantitative thinking; literature research; presentation techniques; facilitation and interaction in a team

- **Psychological key competences:**
  - Recognition and reflexion of the relations between theory, empirical research and application of psychological cognitions. Critical appreciation of research results and methods. Dealing with scientific texts and differentiation between original and secondary literature.

- **Module specific competences:**
  - The students gain fundamental knowledge in the theories, methods, topics and results of psychophysics, perceptual, attentional and consciousness research. They are able to define and differentiate the central theoretical constructs, to assess their scientific investigation in historical context and to comprehend current controversies. Further, they gain insight into the dealing with experimental
procedures as well as into overlapping sections and relations of the General Psychology with other branches of psychology (e.g. Differential Psychology, Developmental Psychology, Social Psychology, Biological Psychology).

Syllabus

In „Allgemeine Psychologie I“ the topics history of psychology, psychophysics, perception, imagination, attention, consciousness, learning and memory are covered. Besides the introduction in historical aspects of the general psychology and psychophysics, central phenomena and concepts like sensory thresholds, signal detection, consistency performances, masking phenomena, after-effects, visual search, vigilance, sleeping, conditioning, phonological loop, visual-spatial storage and others are covered. For all topics there is an introduction in classical and current theories and methods as well as central paradigms and research works.

Literature

The lecture is based on selected chapters of relevant textbooks of cognition psychology that are introduced during the lecture. The literature is partly in English.

Teaching and learning methods

Lecture "Allgemeine Psychologie Ia" (2 SWS, 4 ECTS). Written exam "11952 Vorlesung Allgemeine Psychologie Ia"

Workload

Attendance: 60 h

Private study: 60 h

Sum: 120 h

Assessment

The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

Grading procedure

The grade of the module will be the grade of the exam.

Basis for

-
### Modules referring to Thinking about Science - Subsidiary Subject

<table>
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<th><strong>Code</strong></th>
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<td><strong>Language of instruction</strong></td>
<td>German</td>
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<td><strong>Duration</strong></td>
<td>1 Semester</td>
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<tr>
<td><strong>Cycle</strong></td>
<td>each Semester</td>
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<tr>
<td><strong>Coordinator</strong></td>
<td>Language Centre</td>
</tr>
<tr>
<td><strong>Instructor(s)</strong></td>
<td>Instructors of the Language Centre</td>
</tr>
</tbody>
</table>

**Allocation of study programmes**
Biology MSc, start of studies: winter semester, compulsory elective module, recommended for 1st semester.

**Recommended prerequisites**
Courses are chosen from the offer of the Language Center based on the individual German knowledge.

**Learning objectives**
see course description of the Language Center.

**Syllabus**
see course description of the Language Center.

**Literature**
see course description of the Language Center.

**Teaching and learning methods**
see course description of the Language Center.

**Workload**
see course description of the Language Center.

**Assessment**
The grade of the module will be the grade of the oral or written exam. No prerequisites are necessary for exam registration.
Grading procedure  The grade of the module will be the grade of the exam.

Basis for -
## Elective Module

Modules referring to Thinking about Science - Subsidiary Subject

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<td>see module description of the chosen course.</td>
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<td>Duration</td>
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<td>Cycle</td>
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<tr>
<td>Coordinator</td>
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<tr>
<td>Instructor(s)</td>
<td>see module description of the chosen course.</td>
</tr>
</tbody>
</table>

### Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory elective module

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

### Learning objectives

Syllabus

see module description of the chosen course.

### Literature

see module description of the chosen course.

### Teaching and learning methods

For this module all non-Biological lectures and seminars offered at Ulm University can be completed as long as they are not imputed for another module and the student receives a certificate of achievement. Overall, certificates of achievement in the amount of 6 ECTS are necessary to complete this module.

We recommend the module "20th Century Thinking about Science (Thinking about Science II)" in the Summer Semester (continuation and immersion of the module "Thinking about Science") and / or further German courses from the Language Center.
<table>
<thead>
<tr>
<th><strong>Workload</strong></th>
<th>see module description of the chosen course.</th>
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<tbody>
<tr>
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<td><strong>Grading procedure</strong></td>
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<td><strong>Basis for</strong></td>
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# Thinking about Science

**Modules referring to Thinking about Science - Subsidiary Subject**

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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Semester</td>
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<tr>
<td>Coordinator</td>
<td>Dr. Hans-Peter Eckle</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Hans-Peter Eckle</td>
</tr>
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</table>

### Allocation of study programmes

Biology MSc.

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

### Learning objectives

The course enables the students to take a step back from doing science and rather think and reflect about various issues of science from a meta-perspective. They will gain insights into their work as scientists from an epistemological, historical, and social perspective which furthers their understanding of what it means to do science.

### Syllabus

Stephen C. Stearns (ecologist and evolutionary biologist) in a lecture entitled “The Logic of Science”: “Now science is basically culture's answer to the big problem of epistemology, which is how can we know anything at all?”

Sir Peter Medawar (biologist and Nobel laureate) in an essay “Induction and Intuition in Scientific Thought”: “Ask a scientist what he conceives the scientific method to be, [...] he would probably mumble something about “induction” and “Establishing the Laws of Nature” [...]”

Francis Crick (biophysicist and Nobel laureate) in “Of Molecules and Men”: “The ultimate aim of the modern movement in biology is to explain all biology in terms of physics and chemistry.”
Richard Feynman (physicist and Nobel laureate) in “The Character of Physical Law”: “In general we look for a new law by the following process. First we guess it.”

Werner Heisenberg (physicist and Nobel laureate) in “Physics and Beyond - Encounters and Conversations” recounts a conversation with Einstein: “Possibly I did use this kind of reasoning ["Philosophie" in the German original],” Einstein admitted, "but it is nonsense all the same. [...] It is the theory which decides what we can observe.”

These are snippets of texts in which scientists, arguably, have taken a step back from doing science and rather think about various issues of science.

Not only scientists, but, to quote again Stephen Stearns, “a lot of bright people”, namely (natural) philosophers and others including scientists whenever they put on their “philosophers caps”, have been “occupied” by these issues “for a number of centuries.”

In this course, we discuss those bright people’s contribution to our understanding of science in order to identify the important themes related to the thinking about science which we shall illustrate with examples from physics to biology. In doing so, we shall be let from philosophical considerations to questions of the ethics within science (research ethics) and the relation between society and science.

**Literature**


**Teaching and learning methods**

Format:

We start with introductory lectures to give an overview of the most important positions in the philosophy of science from a historical and thematic perspective including the social and ethical dimension. These overview lectures intend to open up vistas into important debates. Some of these can then be taken up and discussed in more detail and worked out in student presentations and/or papers.

**Workload**

Attendance time: 2 SWS

Self-study: 2SWS

Sum: 4SWS

**Assessment**

The grade of the module will be the grade of the oral exam. No prerequisites are necessary for exam registration.

**Grading procedure**

The grade of the module will be the grade of the exam.

**Basis for**

-
# Introduction to Business Administration

Modules referring to Management and Economics - Subsidiary Subject

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<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. Kai-Uwe Marten</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>All professors and lecturers of Management and Economics</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program. Contentually: None.</td>
</tr>
</tbody>
</table>
| Learning objectives | Students who have successfully completed this module  
  • are familiar with the basic concepts and problems of corporate management.  
  • have learned to apply economic concepts to managerial decisions.  
  • are able to understand intra-company aspects (corporate governance, human resource management, manufacturing) as well as decisions made in interactions with markets (sales, strategy). |
| Syllabus           | This module covers the following subject-specific topics:  
  • Constitutive decisions (legal forms, organizational structure and design, corporate governance, location planning)  
  • Human resource management  
  • Investment (especially net present value rule)  
  • Cost accounting |
• Procurement
• Production
• Sales
• Strategic management (competitive analysis, BCG matrix etc.)

**Literature**
- Bea, Franz Xaver; Schweitzer, Marcell: Allgemeine Betriebswirtschaftslehre, 3 volumes, 9th resp. 10th revised edition, Stuttgart 2006-2011
- Schierenbeck, Henner; Wöhle, Claudia: Grundzüge der Betriebswirtschaftslehre, 17th revised edition, Munich 2008
- Steven, Marion: BWL für Ingenieure, 3rd revised edition, Munich 2008
- Wöhe, Günter; Döring, Ulrich: Einführung in die Allgemeine Betriebswirtschaftslehre, 24th revised edition, Munich 2010

**Teaching and learning methods**
Lecture (3 hours per week) and exercises (1 hour per week)

**Workload**
- Attendance time: 60 h
- Self-study: 120 h
- Sum: 180 h

**Assessment**
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

**Grading procedure**
The grade of the module will be the grade of the exam.

**Basis for**
-
Introduction to Economics
Modules referring to Management and Economics - Subsidiary Subject

Code 8802670726

ECTS credits 6

Attendance time 4

Language of instruction German

Duration 1 Semester

Cycle each Winter Semester

Coordinator Prof. Dr. Kai-Uwe Marten

Instructor(s) Prof. Dr. Georg Gebhardt, Prof. Dr. Werner Smolny

Allocation of study programmes Biology MSc, start of studies: winter semester, compulsory elective module, 1st or 3rd semester

Recommended prerequisites Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives Students who have successfully completed this module are familiar with the fundamental principles of economics such as (1) the use of formal models (optimization, marginal analysis, equilibrium, homo oeconomicus and its behavioral alternatives) (2) Empirical tests of hypotheses (regression analysis, causality, experimental economics). Moreover students are introduced to the most important micro- and macroeconomic applications of these methods (markets, growth, business cycles) together with the associated economic policy questions (development, taxation, monetary and fiscal policy).

Syllabus This module covers the following subject-specific topics:

1) Economic indicators
2) Growth
3) Perfect competition
4) Foundations of perfect competition
5) Business cycles
## Literature
- Wooldridge, Jeffrey M. (2009), Introductory Econometrics, Southwestern, Cengage: 4. Auflage

## Teaching and learning methods
Lecture (3 hours per week) and exercises (1 hour per week)

## Workload
- Attendance time: 60 h
- Self-study: 120 h
- Sum: 180 h

## Assessment
The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

## Grading procedure
The grade of the module will be the grade of the exam.

## Basis for
-
## Molecular Biology for Conservation Genomics A - graded

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### Instructor(s)

Instructors of the involved Biology institutes

### Allocation of study programmes

Biology MSc, start of studies: winter semester, compulsory elective module

### Recommended prerequisites

Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

### Learning objectives

see module description of the chosen course.

### Syllabus

see module description of the chosen course.

### Literature

see module description of the chosen course.

### Teaching and learning methods

For this module all lectures and seminars within the modules of Molecular Bioscience of the master's programme Biology can be completed as long as they are not imputed for another module and the student receives a certificate of achievement for (at least) 3 ECTS.

### Workload

see module description of the chosen course.

### Assessment

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Molecular Biology for Conservation Genomics A - ungraded

Code  8802673948

ECTS credits  3

Attendance time  keine Angaben

Language of instruction  German, English

Duration  1 Semester

Cycle  each Semester

Coordinator  No english version available.

Instructor(s)  Instructors of the involved Biology institutes

Allocation of study programmes  Biology MSc, start of studies: winter semester, compulsory elective module

Recommended prerequisites  Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.

Contentually: None.

Learning objectives  see module description of the chosen course.

Syllabus  see module description of the chosen course.

Literature  see module description of the chosen course.

Teaching and learning methods  For this module all lectures and seminars within the modules of Molecular Bioscience of the master's programme Biology can be completed as long as

Workload  see module description of the chosen course.

Assessment  No english version available.
Grading procedure

No english version available.

Basis for

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# Molecular Biology for Conservation Genomics B - graded

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Grading procedure  No english version available.

Basis for  -
**Molecular Biology for Conservation Genomics B - ungraded**

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| Recommended prerequisites | Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.  
Contentually: None. |
| Learning objectives | see module description of the chosen course. |
| Syllabus       | see module description of the chosen course. |
| Literature     | see module description of the chosen course. |
| Teaching and learning methods | For this module all lectures and seminars within the modules of Molecular Bioscience of the master's programme Biology can be completed as long as |
| Workload       | see module description of the chosen course. |
| Assessment     | No english version available. |
Grading procedure  No english version available.

Basis for  -