Module Descriptions

Master of Science Molecular and Translational Neuroscience

Examination Regulations in the Version of: 2015
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**Master Thesis**

*Modules referring to Master Thesis*

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<td>Supervising professor</td>
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<td><strong>Allocation of study programmes</strong></td>
<td>Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory module, 4th study semester</td>
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<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: Corresponding compulsory and compulsory elective modules of the study course.</td>
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</table>
| **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, 30 credit points

### Workload

- Attendance: 450 h
- Private study: 450 h
- Sum: 900 h

### Assessment

*not specified*

### Grading procedure

*not specified*

### Basis for

Graduation master program
Advanced Molecular and Translational Neuroscience
Modules referring to Compulsory Modules

Code 8830074027

ECTS credits 20

Attendance time 17

Language of instruction english

Duration 1 Semester Semester

Cycle each Winter Semester

Coordinator Jun. Prof. Dr. Andreas Grabbrucker

Instructor(s) Jun. Prof. Dr. Grabbrucker, N/A

Allocation of study programmes Molecular and Translational Neuroscience

Recommended prerequisites Introduction to Molecular and Translational Neuroscience

Learning objectives In the lecture, students should get practical information for translational research. Students should understand valuable case studies of translational neuroscience in action, and methods ranging from transcranial magnetic stimulation to neuroimaging and the use of animal models. Furthermore, students should understand how future generations of translational neuroscientists can utilize the full spectrum of techniques at hand.

In the seminar the major focus is to learn and discuss about scientific methods/techniques and new findings in the field of translational neuroscience. Literature will be chosen from scientific journals (mainly Impact factor >10), such as Nature Neuroscience, Science, etc.. The responsible lecturers will provide assistance in understanding the data and offer consultation time.

After the practical training students should summarize their data in a written report and critically discuss published data related to their project. The practical training will enable insights into current methods in translational Neuroscience and provide hands-on experience.

In the excursion, students should get a real life experience of methods, challenges and opportunities for translational Neuroscience in a commercial background. After the excursion, students will give short presentations to selected topics discussed during the excursion with discussion afterwards.No english version available yet.
Syllabus

• Neuroimaging in translational Neuroscience
  - Magnetic Resonance Imaging as a tool for modeling drug treatment of CNS disorders
  - Structural Magnetic Resonance Imaging for diagnoses
  - Positron Emission Tomography in Alzheimer’s Disease
  - Functional Magnetic Resonance Imaging as Biomarker tool

• Animal models for CNS drug discovery
  - Challenges for Psychopharmacology Research
  - Developing new drugs – from animal to the clinic
  - Animal models for brain disorders (Bipolar Disorder, Autism, Alzheimer, ADHD, Epilepsy, Sleep Disorders, etc.)

• Electrophysiology in translational Neuroscience
  - patch clamp recordings
  - magnetoencephalography

• Drug discovery in translational Neuroscience
  - genetic approaches – screenings
  - cellular approaches (cell models and high throughput analysis)

Seminar translational Neuroscience:

This seminar will present current research findings in the field of translational Neuroscience. Students will give Journal Clubs with discussion afterwards.

Practical training translational Neuroscience:

In the practical training students will learn the analysis of various readout systems used in drug screening approaches.

• Cell health analysis (detection of apoptosis)
  - via Western Blot analysis
  - fluorescence microscopy

• gene expression profiling
  - qRT-PCR

• protein expression profiling
• use of cell lines
  - stem cells and cell lines

• application of drugs and establishment of LD50 values
<table>
<thead>
<tr>
<th>Literature</th>
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</thead>
<tbody>
<tr>
<td>• Translational Neuroscience: A Guide to a Successful Program von Edgar</td>
</tr>
<tr>
<td>Garcia-Rill</td>
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<tr>
<td>• Translational Neuroimaging: Tools for CNS Drug Discovery, Development</td>
</tr>
<tr>
<td>and Treatment von Robert A. McArthur von Academic Press</td>
</tr>
<tr>
<td>• Animal and Translational Models for CNS Drug Discovery von Robert A.</td>
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<td>McArthur und Franco Borsini</td>
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<tbody>
<tr>
<td>Lecture, Seminar and practical training</td>
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<tr>
<td>2 SWS lecture, 2 SWS Seminar, 12 SWS Practical training, 1 SWS Excursion</td>
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## Molecular and Translational Neuroscience

Modules referring to Compulsory Modules

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<tr>
<td>Coordinator</td>
<td>Jun. Prof. Dr. Andreas Grabrucker</td>
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<td>Jun. Prof. Dr. Andreas Grabrucker</td>
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### Allocation of study programmes

MSc Molecular and Translational Neuroscience

### Recommended prerequisites

none

### Learning objectives

Students should be provided with a comprehensive disorder-focused perspective of translational Neuroscience. They should understand the three major classes of brain disorders (psychiatric, neurodegenerative and neurodevelopmental) and their most common past, current and promising future therapeutic approaches. Translational approaches will be discussed especially on molecular level.

### Syllabus

- The discovery and development of drugs to treat brain disorders: Historical perspective
- Translational approaches in psychiatry
- Translational approaches in neurology
- Translational approaches in neurodevelopmental disorders
- Epigenetic mechanisms in central nervous system disorders
- Promises and challenges of translational research in neuropsychiatry

### Literature

Translational Neuroscience by James E. Barrett, Joseph T. Coyle and Michael Williams
<table>
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<th>lecture</th>
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# Neurobiology - Master

Modules referring to Compulsory Modules

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<td>Coordinator</td>
<td>Prof. Dr. Harald Wolf</td>
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<td>Instructor(s)</td>
<td>PD Dr. Stefan Jarau, Prof. Dr. Harald Wolf</td>
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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; preferably basic knowledge in neurobiology from bachelor program.

### 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]
Neurological/Psychiatric Diseases I
Modules referring to Compulsory Modules

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<tr>
<td>Coordinator</td>
<td>Dr. Althaus</td>
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Instructor(s)

Allocation of study programmes
Molecular and Translational Neuroscience

Students from the following study paths may enroll in this module: biochemistry, molecular biology, physiology and neurobiology, human medicine, pharmaceutical biotechnology

Recommended prerequisites
none

Learning objectives
This module gives students theoretical insight into current knowledge about principle mechanisms of physiologic function of the nervous system and pathology of neurological and psychiatric human diseases. Students are introduced to techniques of clinical diagnosis, neuropsychological examination and state of the art of neuroimaging.

After successful accomplishment of this module the students have knowledge about

- the functioning and interaction of the central- and peripheral-nervous system
- specific pathophysiological mechanisms involved in the pathogenesis of neurological / neurodegenerative and psychiatric diseases including disorders of the pyramidal motor and extrapyramidal motor system, dementia, neuromuscular diseases, neuroinflammation, networks of locomotion, schizophrenia, depression, stress and affective disorders
Students have the ability to ascribe clinical symptoms to its underlying pathomechanisms.

**Syllabus**

During the winter semester 32 hours of lectures (2 semester periods per week) will be given comprising:

- Introduction and Neurological Examination
- Peripheral nervous system and Cranial Nerves
- Function of the extrapyramidal and pyramidal motor system
- Brainstem function, coordination and cerebellum
- Mechanisms of neurodegenerative diseases
- Mechanisms of neurovascular diseases and neoplasies of the nervous system
- Mechanisms of neuromuscular disorders
- Mechanisms of neuroinflammation
- Neuroimaging
- Neuropsychology
- Psychiatric disorders and systems neuroscience
- Neurocognitive Deficits in psychiatric disorders
- Dopamine and reward in schizophrenia
- Stress and affective disorders
- Molecular genetics of personality and psychiatric disorders
- final examination (MC)

**Literature**


Exam relevant content:

Neurology: selected parts of „Oxford Handbook of Neurology“ 2nd revised edition; key slides from each lecture

**Teaching and learning methods**

lecture

**Workload**

2 SWS

**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**

Neurological/Psychiatric Diseases II
### Advanced Methods in Molecular and Translational Neuroscience

Modules referring to Advanced Methods

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**Learning objectives**

Students who have successfully completed this module,

- have detailed knowledge which modern working methods can be applied to the processing of typical questions in biology.
- have insight into current research topics.
- are able to familiarize themselves theoretically and methodologically in scientific issues.
- are able to handle results of the research work, summarize the results in protocols and present them to working group for discussion.
- are able to assess their own actions in the light of any applicable laws and regulations.
- have trained their team spirit.

**Syllabus**

In this module, the following technical contents are conveyed:

- The Advanced Lab is carried out in a working group; the subject and scope of the project are set in consultation with the respective head of the Working
Group and are based on current issues from the research area of the supervising university teacher.

- Instructions for literature, literature management.
- Development of the theory of a scientific theme.
- Incorporation into specifically designed tasks required for resolution of the scientific problem.
- Deepening of already known methods, project-related.
- Resolution of the problem, taking into account any applicable laws, rules and regulations: labor law, environmental law, Ordinance on Hazardous Substances, possibly Laboratory Animal Science.
- The specified task is initially under the guidance, then processed independently.

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<th>subject specific literature</th>
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<td><strong>Workload</strong></td>
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Basics of Stress Physiology

Modules referring to Elective Modules

Code 8830074128

ECTS credits 3

Attendance time 2

Language of instruction English

Duration 1 Semester Semester

Cycle each Summer Semester

Coordinator Prof. Dr. rer. nat. Stefan Reber

Instructor(s) Prof. Dr. rer. nat. Stefan Reber

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

Recommended prerequisites Basic knowledge in physiology, endocrinology, and immunology

Learning objectives After successful completion of this module, students know

• at least the milestones in the history in stress research.
• the difference between stressor, stress perception, stress response and what happens during those procedures on a neuronal, neuroendocrine, physiological and behavioural level.
• what the hypothalamus-pituitary-adrenal (HPA) axis and sympathetic nervous system (SNS) is, how those systems are anatomically located in an organism, and what happens during activation of these systems.
• the difference between physical, psychological, social, acute, repeated and chronic stressors.
• what is happening on a physiological level during stress adaptation.
• why a lack of adaptation can be detrimental and how this is mediated.
• what stress resilience and vulnerability is and how these are mediated/ influenced.
• that stress not only changes physiology but also affects the immune system.
• that stress-induced changes in the immune system are involved in development of stress-related somatic and affective disorders and how this is mediated.
• how to read and present a scientific paper in front of an audience.

Syllabus This module covers the following subject-specific topics:
see learning objectives

**Literature**

- any textbook covering mammalian physiology and neuroendocrinology

The following excellent review articles can be additionally employed to get into the field of stress biology:


**Teaching and learning methods**

Behavioral Physiology: 2 hours per week: 1 hour lecture given by Prof. Reber & 1 hours seminar (one student presents a papers from the stress field each week), 2 credit hours, 3 credit points

**Workload**

2 hours per week

**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  -
Biomolecular Systems in Psychiatric Disorders
Modules referring to Elective Modules

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<tr>
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<td>Laura Ramo, Prof. Iris-Tatjana Kolassa</td>
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<td>Master Molecular and Translational Neuroscience</td>
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<td>Recommended prerequisites</td>
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Learning objectives
This seminar will focus on the biomolecular mechanisms that underlie the psychiatric disorders: The role of different biological pathways in disease etiology, diagnosis and response to treatment/psychotherapy will be of major importance during this seminar.

We will assess interesting topics such as the possible utilization of biomarkers for clinical diagnosis, potential molecular treatment targets and interaction of the biological systems with the environment to predict disease outcome and severity.

Syllabus
Knowledge acquisiton of...

- ... main biological systems that usually appear altered in relation to clinical psychological disorders
- ... biological characterization of psychological disorders : symptoms, neurobiological changes, genetic and epigenetic factors, gene x environment interactions...
- ... tools for literature research
- ... critical discussion of research papers
- ... how to present complex issues
- ... proper scientific writing
<table>
<thead>
<tr>
<th><strong>Literature</strong></th>
<th>You will be supplied with a list of scientific literature that will introduce you to the matter (research-highlights).</th>
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<tbody>
<tr>
<td><strong>Teaching and learning methods</strong></td>
<td>Oral presentation + written summary</td>
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</table>
| **Seminar- Schedule** | • 40-50 min. presentation of the chosen topic (when 2 students present the same day: each 20 mins)  
• 10-20 min. "active element" with the group  
• 20-30 min. discussion |
| **Workload** | 2 SWS |
| **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** | - |
# Brain Imaging and Neuroanatomy

Modules referring to Elective Modules

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<td>Prof. Dr. rer. nat. Volker Rasche</td>
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**Allocation of study programmes**
Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 2nd study semester

**Recommended prerequisites**
-

**Learning objectives**
Different methods of brain imaging
- PET
- fMRI
- MRT
To understand physiology, pathology and morphology of the brain

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

**Literature**
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Neural Networks in Health and Disease
Modules referring to Elective Modules

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<tr>
<td>Duration</td>
<td>1 Semester Semester</td>
</tr>
<tr>
<td>Cycle</td>
<td>each Summer Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Francesco Roselli, MD PhD</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Francesco Roselli, MD PhD</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory elective module, 2nd study semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Basic cell biology, biochemistry, pharmacology</td>
</tr>
<tr>
<td>Learning objectives</td>
<td>After successful completion of this module, students will understand the basic arrangement of local and long-range microcircuitry in brain and spinal cord in physiological conditions and the will be knowledgeable about the basic and advanced methods for structural (viral tracing, genetic intersectional tracing) and functional (optogenetics, chemiogenetics) approaches to neuronal network investigation and manipulation. Students will know how local microcircuitry in brain and spinal cord changes in pathological conditions such as epilepsy, chronic pain, autism, alzheimer’s disease; students will learn how to critically evaluate the new findings in this field. Students will also led to appreciate what are the uncertantiy areas in the neuronal network field, and which type of information is still missing.</td>
</tr>
<tr>
<td>Syllabus</td>
<td>This module covers the following subject-specific topics:</td>
</tr>
<tr>
<td></td>
<td>• Basic assemblies of neuronal networks and microcircuitry: feed-back and feed-forward inhibition and excitation, basic assembly of recurrent neuronal networks</td>
</tr>
<tr>
<td></td>
<td>• Techniques and approaches for neuronal circuitry structural analysis: viral and non-viral tracing, volumetric imaging, genetic intersectional tracing.</td>
</tr>
<tr>
<td></td>
<td>• Techniques and approaches for neuronal circuitry functional analysis: in vivo imaging, in vivo electrophysiology.</td>
</tr>
</tbody>
</table>
- Techniques and approaches for neuronal circuitry manipulation: optogenetics, chemiogenetics, subpopulation ablation
- Structure and function of sensory spinal cord networks in normal and chronic pain conditions
- Structure and function of motor spinal cord networks in traumatic spinal cord injury
- Structure and function of hippocampal and cortical circuitry in learning and in alzheimer’s disease
- Structure and function of dopaminergic networks in parkinson's disease
- Structure and function of cortical and thalamic networks in epilepsy

| Literature | • Kandel-Schwarz-Jessel “Principles of Neuroscience” fifth edition  
|            | • Review and original articles from top neuroscience journals |

| Teaching and learning methods | • Behavioral Physiology (lecture), 2 credit hours, 3 credit points |

| Workload | 2 SWS |

| 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 | - |
Advanced Neurobiology
Modules referring to Advanced Neurobiology

Code  8830070562

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\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)

<table>
<thead>
<tr>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Specific literature for laboratory course and seminar topics</td>
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<table>
<thead>
<tr>
<th>Teaching and learning methods</th>
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<tbody>
<tr>
<td>- Sensory Motorsystems and Behavioral Control (lecture), 4 credit hours [SWS], 6 credit points [LP]</td>
</tr>
<tr>
<td>- Advanced Neurobiology (seminar), 2 credit hours [SWS], 3 credit points [LP]</td>
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<tr>
<td>- Advanced Neurobiology (laboratory course), 12 credit hours [SWS], 12 credit points [LP]</td>
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<thead>
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<th>Workload</th>
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<tr>
<td>Attendance: 270 h</td>
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<tr>
<td>Private study: 360 h</td>
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<tr>
<td>Sum: 630 h</td>
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<table>
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</table>

<table>
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<tr>
<th>Grading procedure</th>
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<tr>
<td>The grade of the module will be the grade of the exam.</td>
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<th>Basis for</th>
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<tr>
<td>Master thesis in the area of behavioral biology or neurobiology</td>
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### European Patent Law for Molecular and Translational Neuroscience

Modules referring to Medical Neuroscience and European Law

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<td>Duration</td>
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<tr>
<td>Cycle</td>
<td>each Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>N/A</td>
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<tr>
<td>Instructor(s)</td>
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**Allocation of study programmes**

- Molecular and Translational Neuroscience MSc, start of studies: winter semester, compulsory module, 1<sup>st</sup> study semester
- Biology MSc, start of studies: winter semester, compulsory 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: None.

**Learning objectives**

European Patent Law

Knowledge of the basics of European patent law.

**Syllabus**

This Module covers the Following subject-specific topics:

European Patent Law

- Part 1: Use of powers, exhaustion use powers, patent infringement, prior use, limiting the effect of the patent scope, infringement of property rights, the right to the invention
- Part 2: novelty, inventive step Tätigleit, industrial applicability
- Part 3: procedural rights, general regulations, representation, patent application, granting procedures, abolition of patents, opposition, nullity
| **Literature** | Literature will be given during the lecture |
| **Teaching and learning methods** | European Patent Law = Patentrecht für naturwissenschaftler (V), 1 SWS, 3 LP |
| **Workload** | European Patent Law |
| | Attendance: 15 h |
| | Private study: 75 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** | - |
Medical Neuroscience II
Modules referring to Medical Neuroscience and European Law

Code
8830070087

ECTS credits
15

Attendance time
14

Language of instruction
English

Duration
2 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 interpret 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
| **Workload**   | Attendance: 210 h  
|               | Private study: 240 h  
|               | Sum: 450 h  |
| **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**   | -  |
Medical Products for Molecular and Translational Neuroscience

Modules referring to Medical Neuroscience and European Law

Code 8830074026

ECTS credits 3

Attendance time 2

Language of instruction English

Duration 1 Semester

Cycle each Semester

Coordinator N/A

Instructor(s) Dr. Helmut Reitzle, 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

• Molecular and Translational Neuroscience 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 none

Learning objectives

Arzneimittelseminar (Medical Products): students

have knowledge of the drug development process generally, as well as chemical-pharmaceutical and pharmacological-toxicological level in particular by reference to appropriate legal regulations.

have knowledge under what legal conditions new drugs are transferred into clinical adoption.

have an idea of how clinical trials are constructed and how to interpret resulting data.

have knowledge in the areas of drug safety and authorization of medicines.

Syllabus Medical Products:
Introduction, history of drug development, overview of the process of drug development, regulations

Chemical-Pharmaceutical Development I: Drug Discovery

Chemical-Pharmaceutical Development II: Finished product development

Pharmacological-toxicological development I: Drug Discovery and preclinical development to first-in-man

Pharmacological-toxicological development II: Toxicology and safety pharmacology

Pharmacological-toxicological development III: Pharmacokinetics and Metabolism

Clinical examination: first application in humans to prove effectiveness and safety

Planning, implementation, standards and regulations

Drug information and labeling

Drug safety: basics

Drug safety: Structure and Risk Management

Biopharmaceutical medicines: development, manufacture, testing

Generics: quality, substitution

Authorization of medicinal products in Germany

Authorization of medicinal products in the EU

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<tr>
<th>Literature</th>
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<tbody>
<tr>
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<td>Workload</td>
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<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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## From Basic Research to Product

Modules referring to Compulsory Elective II

### Code
8830074040

### ECTS credits
6

### Attendance time
4

### Language of instruction
English

### Duration
1 Semester Semester

### Cycle
each Summer Semester

### Coordinator
Prof. Dr. Hengerer, Dr. Sommer

### Instructor(s)
Lecture series with lecturers from Boehringer Ingelheim

### Allocation of study programmes
Molecular and Translational Neuroscience MSc, SoSe, 2nd semester

### Recommended prerequisites
-

### Learning objectives
- Understand the value creation chain in pharmaceutical research and development.
- Have basic knowledge of the processes in pharma research
- Understand the interdependence of the various working packages
- Are aware of critical parameters in translating preclinical results to clinical effects

### Syllabus
- Basic knowledge of the process for identification and validation of novel target molecules in the context of the unmet medical need
- Genetics of neurodegenerative diseases
- Neuroimmunology
- Neurogenesis
- Neuronal circuits and optogenetics
- Synaptic plasticity, learning and memory
- Role, value and predictive power of animal models in psychiatric diseases
- Generation and application of gene-modified rodents
- Selection and application of suitable in vivo tests and assays
- Non-invasive functional imaging and related methods
- Methods and processes for compound identification and characterization
- Course of the preclinical research phases
- High throughput screening and automatization
- Biologicals for the treatment of CNS diseases
- Cellular imaging, calcium imaging, high content screening
- Specific questions at the transition from preclinical to clinical phases
- Properties of drug candidates e.g. DMPK
- Identification and selection of suitable biomarkers
- Issues and phase transitions in clinical research

<table>
<thead>
<tr>
<th>Literature</th>
<th>Literature will be provided beforehand</th>
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| Teaching and learning methods | | |
|-----------------------------|-----------------|
|                             | Lecture         |
|                             | Seminar         |
|                             | Excursion       |

<table>
<thead>
<tr>
<th>Workload</th>
<th>2 SWS, 3ECTS lecture and 2 SWS, 3 ECTS, seminar with excursion</th>
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Clinical Trials for Molecular and Translational Neuroscience
Modules referring to Compulsory Elective II

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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. Schuster</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Dr. Schuster, Dr. Grabrucker, Members of the Neurocenter Ulm</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>Molecular and Translational Neuroscience MSc, Studienbeginn WiSe, Wahlpflichtmodul, 2nd semester</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
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</tr>
<tr>
<td>Learning objectives</td>
<td>Students who have successfully completed this module,</td>
</tr>
<tr>
<td></td>
<td>Lecture:</td>
</tr>
<tr>
<td></td>
<td>• Students will be provided with a comprehensive overview on clinical trials. They will learn about the life cycle of pharmaceutical drugs and the steps needed to come from pre-clinical research to a marketing authorization.</td>
</tr>
<tr>
<td></td>
<td>Seminar:</td>
</tr>
<tr>
<td></td>
<td>• know how to present scientific data in a predetermined time, such as a lecture will be well prepared and presented visually and how to outlining new evidence carefully.</td>
</tr>
<tr>
<td></td>
<td>• have language skills in technical English.</td>
</tr>
<tr>
<td></td>
<td>• are to be decided in a position as to whether a study was well conducted and scientifically planned carefully.</td>
</tr>
<tr>
<td></td>
<td>• know how to discuss new scientific data.</td>
</tr>
<tr>
<td>Practical training:</td>
<td></td>
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</table>

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The practical training will be held in the center for clinical research of the department Neurologie (University Hospital Ulm). Students will be involved in the setup, management and conduct of clinical trials.

Syllabus

Lecture:
- History of standards in clinical trials
- Development cycle of pharmaceutical drugs and medicinal products
- Individual steps from first in human to marketing authorization
- Parties involved in clinical trials and their roles and responsibilities
- Regulatory requirements in clinical trials
- Safety and Pharmacovigilance

Seminar:
- The focus of this seminar is on learning and discussion of scientific methods / techniques and new findings
- Recent research by research groups of the University of Ulm Neurocenter
- Latest scientific publications in the field of neuroscience

Practical training:
- Setup and management of clinical trials
- Roles and responsibilities
- ICH-GCP guidelines
- Source documentation and electronic data capture
- Storage and handling of study drug
- Storage and handling of bio samples
- Management of Serious Adverse Reaction (SAE) and pharmacovigilance

Literature

Praxisbuch Klinische Forschung von Michael Herschel

Teaching and learning methods

- Seminar Neurological Diseases 1,5 SWS, 2 LP
- Lecture, 2 SWS, 3 LP
- Practical training, 4 SWS, 4LP

Workload

N/A

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

-
# Neurological/Psychiatric Diseases II

Modules referring to Compulsory Elective II

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<td><strong>Duration</strong></td>
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<td><strong>Coordinator</strong></td>
<td>Dr. Althaus</td>
</tr>
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**Allocation of study programmes**

Molecular and Translational Neuroscience MSc, SoSe, Wahlpflichtmodul, 2nd semester

Students from the following study paths may enroll in this module if they have successfully participated in module 3: biochemistry, molecular biology, physiology and neurobiology, human medicine, pharmaceutical biotechnology

**Recommended prerequisites**

Mandatory participation in Neurological/Psychiatric Diseases I (modul 3)

**Learning objectives**

This module builds on the teaching and learning content of “Neurological/Psychiatric Diseases I”. Based on the knowledge about physiologic functioning and principle mechanisms of pathologic changes, the students get insight into the major diseases and syndromes in neurology and psychiatry, complemented by learning contents about clinical studies and the intersection between clinical medicine and research (e.g. neuroimaging, cerebrospinal fluid, brainstimulation) as well as psychosomatic medicine and psychology. Lectures and seminars will include hands-on parts with the presentation of patients and diagnostic procedures of the respective diseases.

After successful accomplishment of this module the students have knowledge about

- syndroms, diagnosis and treatment of the major neurological and psychiatric diseases
- Scopes and conduction of clinical studies
Syllabus

Lectures (2 semester periods per week) & Seminars (2 semester periods per week). Thematically corresponding lectures and seminars will be joint within a week.

- Introduction and neurodegenerative diseases I (motoneuron disease) and myopathies
- Neurodegenerative diseases II (movement disorders)
- Neurodegenerative diseases III (dementia)
- Cerebrovascular diseases
- Epilepsy
- Acute and chronic inflammatory diseases
- liquor cerebrospinalis in clinical diagnosis and research
- Advanced techniques in neuroimaging
- Clinical Studies (from preclinic to drug approval)
- Neuroimaging and affective disorders
- Brainstimulation in affective disorders
- Psychosomatic Medicine
- Psychology
- final examination (MC)

Literature


exam relevant content:
Neurology: selected parts of „Oxford Handbook of Neurology“ 2nd revised edition; key slides from each lecture, handouts from seminars if existing

Teaching and learning methods

lectures, seminars

Workload

Präsenzstudium: 56 h
Selbststudium: 124 h
Summe: 180 h

Assessment

No english version available yet.

Grading procedure

No english version available yet.
Basis for -
# Behavioral Physiology

Modules referring to Behavioral Physiology

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<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>
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<tr>
<td>• Biology MSc, start of studies: winter semester, compulsory elective module, 2nd study semester recommended</td>
</tr>
<tr>
<td>• Molecular and Translational Neuroscience MSc, summer semester, compulsory elective module, 2nd study semester</td>
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<table>
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<tbody>
<tr>
<td>Formally: Refer to the subject-specific examination regulations of the respective study course, in the version effective when taking up the study program.</td>
</tr>
<tr>
<td>Contentually: good knowledge in behavioral biology and neurobiology, e.g. bachelor program in animal physiology, neurobiology.</td>
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<table>
<thead>
<tr>
<th>Learning objectives</th>
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<tbody>
<tr>
<td>Students who have successfully completed this module</td>
</tr>
<tr>
<td>• know the elements and their function in neural control circuits, including efferent and behavioral control.</td>
</tr>
<tr>
<td>• have gained a deeper understanding of the mechanism that elicit and control instinctive and learned behavior in animals.</td>
</tr>
<tr>
<td>• are able to understand the biological basic control principles of, and evolutionary reasons for social behavior in animals.</td>
</tr>
<tr>
<td>• have gained practical experience in handling laboratory animals.</td>
</tr>
<tr>
<td>• are able to create experimental designs for behavioral tests in animals in the laboratory and in the field.</td>
</tr>
<tr>
<td>• 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.</td>
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</table>
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