Module Catalogue
Master’s Programme: Neurosciences
(Master of Science, M.Sc.)

(120 ECTS credits)
Based on the Prüfungs- und Studienordnung of 29.11.2019
88/430/---/M0/H/2018
Issued on 06 December 2019
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Abbreviations and annotations

CP Credit Points, ECTS credits
ECTS European Credit Transfer and Accumulation System
h hours
SoSe summer semester
SWS contact hours
WiSe winter semester
WP compulsory elective
P mandatory

1. The ECTS credits assigned in the Module Catalogue are designated as follows: Credit Points not listed in parentheses are awarded when the pertinent examination of the module or module parts have/has been completed successfully. Credit Points in parentheses are listed for calculatory purposes only.

2. The semester for taking a module can either be binding or may be considered as a recommendation, depending on the applicable data in Anlage 2 of the Prüfungs- und Studienordnung for your Programme. In this Module Catalogue, the options are indicated as „scheduled semester“ and „recommended semester“.

3. Please note: The Module Catalogue is merely intended to serve as an orientation whereas the provisions of the applicable version of the Prüfungs- und Studienordnung (in German only) of your Programme are legally binding. See: www.lmu.de/studienangebot and select your Programme.
Module: P 1 Fundamentals in Neuroscience I

Programme
Master's Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>P 1.1 Fundamentals in Neuroscience 1 - Lecture</td>
<td>WiSe</td>
<td>60 h (4 SWS)</td>
<td>90 h</td>
<td>(5)</td>
</tr>
<tr>
<td>Tutorial</td>
<td>P 1.2 Fundamentals in Neuroscience 1 - Tutorial</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
MSc Biochemistry, MSc Neurocognitive Psychology, MSc Human Biology, MSc other, BSc Biology extended

Elective guidelines
None

Entry requirements
None

Semester
Scheduled semester: 1

Duration
The completion of the module takes 1 semester.

Content
Lecture provides an introduction to fundamental principles in Neuroscience. The lecture consists of 27 topics which are organized in 4 blocks: (1) Cellular and molecular basics, synapses, electrophysiology, Neuronal networks (2) Nervous System Development (3) Comparative Neurobiology and Evolution of Brains (4) Plasticity: Learning and Memory. The lecture is accompanied by a tutorial which is a guided augmentation in topics of the lecture and basic knowledge from different fields by senior students of the MSc. Neurosciences program.

Learning outcomes
After successfully completing this module, students will have an insight in fundamental principles in neurosciences and are able to reproduce the covered topics.

Type of examination
Written exam or oral examination

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
<table>
<thead>
<tr>
<th><strong>Responsible contact</strong></th>
<th>Prof. Dr. Laura Busse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed schedule of topics, dates and lecture handouts are available at the LMU Online directory and accessible for registered students.</td>
</tr>
</tbody>
</table>
## Module: P 2 Systems Neuroscience I

**Programme**

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

### Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>P 2.1 Systems Neuroscience 1 - Lecture</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 2.2 Systems Neuroscience 1 - Seminar</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

### Module type

Mandatory module with mandatory courses

### Usability of the module in other Programmes

Open for other MSc programs

### Elective guidelines

None

### Entry requirements

None

### Semester

Scheduled semester: 1

### Duration

The completion of the module takes 1 semester.

### Content

The lecture General Sensory Physiology covers the principles of sensory processing, sensory-motor interactions, and the physics of adequate stimuli. A detailed description of the peripheral and central stages of each specific sensory system is accompanied by theoretical concepts of the underlying neuronal processing. The following topics are covered by participating lecturers:

1. An introduction to principles of invertebrate visual processing in the periphery and CNS, with an emphasis on neuronal substrates and models of motion detection
2. Fundamentals of visual processing in vertebrates: peripheral transduction, and neuronal representations of visual input across different stages of the central visual pathway
3. The mechanosensory lateral line system of aquatic animals and its role in the detection, identification and localisation of objects on the water surface or within the water body
4. Electreception: peripheral and central properties of independently evolved systems, and the systems’ role in object detection, orientation, and communication
5. The ontogenesis of the vestibular system and general
aspects of sensory-motor interaction  
(6) Clinical aspects of disorders in the vestibular system of humans  
(7) Properties of diverse magnetoreceptive systems  
(8) Principles of several chemoreceptive systems, peripheral and central processes of the gustatory and the olfactory system, multimodal interactions  
(9) Peripheral and central stages of somatosensory systems, and their function  
(10) Mechanisms of pain, and temperature perception  

<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Gain an understanding of the principles of peripheral and central sensory processing, as well as physiological and motor responses, and behavioural consequences. The students should be able to outline these basic principles and transfer their knowledge into an exam situation. Students will obtain the fundamental knowledge required to participate in further specialized courses of the Master Program and will acquire the basic knowledge prerequisite to physiological research.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of examination</td>
<td>Written exam and presentation</td>
</tr>
<tr>
<td>Type of assessment</td>
<td>The successful completion of the module will be graded.</td>
</tr>
<tr>
<td>Requirements for the gain of ECTS credits</td>
<td>ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.</td>
</tr>
<tr>
<td>Responsible contact</td>
<td>Prof. Dr. Oliver Behrend</td>
</tr>
<tr>
<td>Language(s)</td>
<td>English</td>
</tr>
<tr>
<td>Additional information</td>
<td>Detailed schedule of topics and dates and lecture handouts are available at the LMU Online directory and accessible for registered students.</td>
</tr>
</tbody>
</table>
Module: P 3 Research Project I

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course</td>
<td>P 3.1 Research Project 1 - Practical Course</td>
<td>WiSe</td>
<td>75 h (5 SWS)</td>
<td>75 h</td>
<td>(5)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 3.2 Research Seminar - Topics in Neurosciences</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 180 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
The students choose a lab and research topic based on their own interest. It is recommended to study the research expertise of faculty members as available on our homepage:
http://www.mcn.uni-muenchen.de/members

Entry requirements
None

Semester
Scheduled semester: 1

Duration
The completion of the module takes 1 semester.

Content
Content of this research project is guided work on a scientific question from the field of systems neurobiology.

Learning outcomes
Goal of this research project is gaining practice in elementary skills of scientific working and good laboratory practice.

Type of examination
Record and presentation

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact
Members of the faculty of the Graduate School of Systemic Neurosciences

Language(s)
English

Additional information
None
Module: P 4 Methods in Neuroscience

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>P 4.1 Comparative Anatomy and Neuroanatomy - Practical Course</td>
<td>WiSe</td>
<td>45 h (3 SWS)</td>
<td>45 h</td>
<td>3</td>
</tr>
<tr>
<td>Exercise</td>
<td>P 4.2 Neurophysiology and Biophysics - Practical Course</td>
<td>WiSe</td>
<td>45 h (3 SWS)</td>
<td>45 h</td>
<td>3</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 180 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
None

Entry requirements
None

Semester
Scheduled semester: 1

Duration
The completion of the module takes 1 semester.

Content
Contents of this module are fundamental methods in neuroscience such as comparative neuroanatomy of vertebrates and electrophysiological properties of neurons.

Learning outcomes
In this module students are introduced to in neuroscience methods, project work, and analysis and presentation of data in systems neurobiology. The students will perform their own experiments in small groups.

Type of examination
Presentation

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact
Dr. Rosario Sanchez Gonzalez & Dr. Cornelia Kopp-Scheinpflug

Language(s)
English
Additional information

Detailed course information is provided as handout.
Module: WP 1 Basics in Systemic, Cellular and Molecular Neuroscience

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 1.1 Basics in Systemic, Cellular and Molecular Neuroscience - Lecture</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 1.2 Basics in Systemic, Cellular and Molecular Neuroscience - Practical Course</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Compulsory elective module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be chosen. By choosing the compulsory elective field "Computational Neuroscience", the compulsory elective modules WP 1, WP 4, WP 5, WP 7 and WP 8 must be taken.

Entry requirements
None

Semester
Recommended semester: 1

Duration
The completion of the module takes 1 semester.

Content
The module covers basic theoretical and practical principles in systemic, molecular and cellular neuroscience. Students perform own experiments including analysis and presentation in small groups.

Learning outcomes
Preparation, performance and analysis of neurobiological experiments using different methods.

Type of examination
Written exam

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed.
successfully.

<table>
<thead>
<tr>
<th><strong>Responsible contact</strong></th>
<th>Dr. Otto Albrecht</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed course information is provided as handout.</td>
</tr>
</tbody>
</table>
## Module: WP 2 Advanced Systemic, Cellular and Molecular Neuroscience

### Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

### Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 2.1 Advanced Systemic, Cellular and Molecular Neuroscience - Lecture</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 2.2 Advanced Systemic, Cellular and Molecular Neuroscience - Practical Course</td>
<td>WiSe</td>
<td>75 h (5 SWS)</td>
<td>75 h</td>
<td>(5)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 180 hours have to be invested.

### Module type
Compulsory elective module with mandatory courses

### Usability of the module in other Programmes
None

### Elective guidelines
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be chosen. By choosing the compulsory elective field "Systemic, Cellular and Molecular Neuroscience", the compulsory elective modules WP 2, WP 3 and WP 6 must be taken.

### Entry requirements
None

### Semester
Recommended semester: 1

### Duration
The completion of the module takes 1 semester.

### Content
Contents of this module are fundamental methods in neuroscience such as neuroanatomy and neurohistology of vertebrate sensory systems and corresponding psychophysics.

### Learning outcomes
In this module students are introduced to in neuroscience methods, project work, and analysis and presentation of data in systems neurobiology. The students will perform their own experiments is small groups.

### Type of examination
Written exam

### Type of assessment
The successful completion of the module will be graded.

### Requirements for the gain of
ECTS credits will be granted when the module examination
## ECTS credits
(or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

## Responsible contact
Dr. Alexander Kaiser & Dr. Steffen Katzner

## Language(s)
English

## Additional information
Detailed course information is provided as handout.
Module: WP 3 Basics in Computational Neuroscience

Programme

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 3.1 Basics in Computational Neuroscience - Lecture</td>
<td>WiSe</td>
<td>45 h (3 SWS)</td>
<td>45 h</td>
<td>(3)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

Module type

Compulsory elective module with mandatory course

Usability of the module in other Programmes

Basic course in related MSc programs

Elective guidelines

With regard to the compulsory elective fields “Systemic, Cellular and Molecular Neuroscience” and “Computational Neuroscience”, one compulsory elective field must be chosen. By choosing the compulsory elective field "Systemic, Cellular and Molecular Neuroscience ", the compulsory elective modules WP 2, WP 3 and WP 6 must be taken.

Entry requirements

None

Semester

Recommended semester: 1

Duration

The completion of the module takes 1 semester.

Content

The lecture builds on high-school-level mathematics (Abiturniveau) and aims to provide an overview of current theoretical, mathematical and computational methods and models used in neuroscience. The following topics are addressed: Biophysics and electrical models of the cell membrane, equivalent circuits, Hodgkin-Huxley equations, phase-plane analysis, neural oscillator models, basics of neuronal coding and decoding, supervised (classification, regression) and unsupervised (clustering, dimensionality reduction, principal component analysis) methods for data analysis.

Learning outcomes

The students will be able to understand the functioning and applicability of standard computational neuroscience methods, and be able to interpret results derived with these methods.

Type of examination

Written exam or oral examination
<table>
<thead>
<tr>
<th><strong>Type of assessment</strong></th>
<th>The successful completion of the module will be graded.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements for the gain of ECTS credits</strong></td>
<td>ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.</td>
</tr>
<tr>
<td><strong>Responsible contact</strong></td>
<td>Prof. Andreas Herz</td>
</tr>
<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>None</td>
</tr>
</tbody>
</table>
**Module: WP 4 Theoretical Biophysics and Cellular Physiology**

**Programme**
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 4.1 Theoretical Biophysics and Cellular Physiology - Lecture</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 4.2 Theoretical Biophysics and Cellular Physiology - Practical Course</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>0 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 90 hours have to be invested.

**Module type**
Compulsory elective module with mandatory courses

**Usability of the module in other Programmes**
Other related MSc programs

**Elective guidelines**
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be chosen. By choosing the compulsory elective field "Computational Neuroscience", the compulsory elective modules WP 1, WP 4, WP 5, WP 7 and WP 8 must be taken.

**Entry requirements**
None

**Semester**
Recommended semester: 1

**Duration**
The completion of the module takes 1 semester.

**Content**
The lecture builds on the Bachelor’s level mathematics and physics (BSc. Biology), and aims to provide an overview and fundamental understanding of standard models and methods used to describe information processing in single neurons and small networks of neurons. The following topics will be addressed: Diffusion, electrical models of the membrane, Goldman-Hodgkin-Katz Flux and equilibrium voltage, equivalent circuits, Hodgkin-Huxley equations, phase-plane analysis, neural oscillator models, linear stability analysis, graded-response models, bistability and competition in networks of graded-response neurons, models of synaptic short-term plasticity, local field potentials.

In the exercise, the students will solve mathematical and programming problems that help them to more deeply understand and critically discuss topics of the lecture:

<table>
<thead>
<tr>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The students will be able to integrate knowledge from experimental and theoretical cellular neurophysiology. They will be able apply to apply this knowledge to evaluate experimental findings and to critically assess the outcome of modeling studies. Students will also be able to devise simple mathematical models to describe neurophysiological phenomena.</td>
</tr>
</tbody>
</table>

The students will be able to use mathematical and computational methods to solve standard problems in theoretical neurophysiology and communicate their findings to experimental and computational neuroscientists.

<table>
<thead>
<tr>
<th>Type of examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam or oral examination</td>
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</tbody>
</table>

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<th>Requirements for the gain of ECTS credits</th>
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<table>
<thead>
<tr>
<th>Responsible contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Christian Leibold</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>
Module: WP 5 The Neural Code

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 5.1 The Neural Code - Lecture</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>0 h</td>
<td>1</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 5.2 The Neural Code - Practical Course</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>2</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Compulsory elective module with mandatory courses

Usability of the module in other Programmes
Other related MSc programs

Elective guidelines
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be chosen. By choosing the compulsory elective field "Computational Neuroscience", the compulsory elective modules WP 1, WP 4, WP 5, WP 7 and WP 8 must be taken.

Entry requirements
None

Semester
Recommended semester: 1

Duration
The completion of the module takes 1 Semester.

Content
The lecture builds on the Bachelor’s level mathematics and physics (BSc. Biology), and aims to provide an overview and fundamental understanding of standard methods and analytical techniques used to quantify neuronal activity and information processing. The following topics are addressed: Spectral analysis, convolution, linear systems theory, receptive fields, spike-triggered averages, reverse correlation, Bayesian decoding, Fisher Information, Gibbs-Shannon Information.

In the exercise, the students will solve mathematical and programming problems that help them to more deeply understand and critically discuss topics of the lecture: Spectral analysis, convolution, linear systems theory, receptive fields, spike triggered averages, reverse correlation, Bayesian decoding, Fisher Information, Gibbs-Shannon Information.
### Learning outcomes

The students will be able to integrate knowledge from experimental and theoretical systems neuroscience. They will be able apply this knowledge to evaluate experimental findings and to critically assess the outcome of data analytical studies. Students will also be able to devise simple statistical analyses to describe systems-neuroscience phenomena.

The students will be able to use mathematical and computational methods to solve standard problems in theoretical systems neuroscience and communicate their findings to experimental and computational neuroscientists.

### Type of examination

Written exam

### Type of assessment

The successful completion of the module will be graded.

### Requirements for the gain of ECTS credits

ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

### Responsible contact

Dr. Thomas Wachtler

### Language(s)

English

### Additional information

None
# Module: P 5 Fundamentals in Neuroscience II

## Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

## Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>P 5.1 Fundamentals in Neuroscience 2 - Lecture</td>
<td>SoSe</td>
<td>60 h (4 SWS)</td>
<td>90 h</td>
<td>(5)</td>
</tr>
<tr>
<td>Tutorial</td>
<td>P 5.2 Fundamentals in Neuroscience 2 - Tutorial</td>
<td>SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

## Module type
Mandatory module with mandatory courses

## Usability of the module in other Programmes
MSc Biochemistry, MSc Neurocognitive Psychology, MSc Human Biology, MSc other, BSc Biology extended

## Elective guidelines
None

## Entry requirements
None

## Semester
Scheduled semester: 2

## Duration
The completion of the module takes 1 semester.

## Content
Lecture provides an introduction to fundamental principles in Neuroscience. The lecture consists of 21 topics which are organized in 4 blocks: (1) Motor Systems (2) Neuroethology (3) Cognition (4) Translational Neuroscience. The lecture is accompanied by a tutorial which is a guided augmentation in topics of the lecture and basic knowledge from different fields by senior students of the MSc Neurosciences program.

## Learning outcomes
After successfully completing this module, students will have an insight in fundamental principles in neurosciences and are able to reproduce the covered topics.

## Type of examination
Written exam or oral examination

## Type of assessment
The successful completion of the module will be graded.

## Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

## Responsible contact
Prof. Laura Busse
<table>
<thead>
<tr>
<th>Language(s)</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed schedule of topics, dates and lecture handouts are available at the LMU Online directory and accessible for registered students.</td>
</tr>
</tbody>
</table>
Module: P 6 Neurophilosophy

Programme

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>P 6.1 Neurophilosophy - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 6.2 Neurophilosophy - Seminar</td>
<td>WiSe</td>
<td>30 h (2 SWS)</td>
<td>150 h</td>
<td>(6)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 270 hours have to be invested.

Module type

Mandatory module with mandatory courses

Usability of the module in other Programmes

Other related MSc programs

Elective guidelines

None

Entry requirements

None

Semester

Scheduled semester: 1 and 2

Duration

The completion of the module takes 2 semesters.

Content

Contents of this module are: (I) Philosophy of Mind (Perception, Language, Cognition, Consciousness, Mind-Body-Problem); (II) Anthropology (Ethics, Free Will and Responsibility, Determinism); (III) Philosophy of Science (Methodology, Theory and Experience, Explanation, Reductionism); (IV) Neuroscience and the History of Ideas.

Learning outcomes

Goal of this module is gaining knowledge of central neurophilosophical questions and methods; Capability to analyze, critically discuss, and work out well-reasoned positions in the field of neurophilosophy, both in systematic and historical perspectives.

Type of examination

Presentation and essay

Type of assessment

The successful completion of the module will be graded.

Requirements for the gain of ECTS credits

ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact

Prof. Stephan Sellmaier & Prof Ophelia Deroy
Module: P 7 Research Project II

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course</td>
<td>P 7.1 Research Project 2 - Practical Course</td>
<td>SoSe</td>
<td>75 h (5 SWS)</td>
<td>75 h</td>
<td>(5)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 7.2 Research Seminar - Advanced Topics in Neurosciences</td>
<td>SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 180 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
The students choose a lab and research topic based on their own interest. It is recommended to study the research expertise of faculty members as available on our homepage: http://www.mcn.uni-muenchen.de/members

Entry requirements
None

Semester
Scheduled semester: 2

Duration
The completion of the module takes 1 semester.

Content
Content of this research project is guided work on a scientific question from the field of systems neurobiology.

Learning outcomes
Goal of this research project is gaining practice in elementary skills of scientific working and good laboratory practice.

Type of examination
Report and presentation

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact
Members of the faculty of the Graduate School of Systemic Neurosciences

Language(s)
English
Additional information None
### Module: WP 6 Special Methods in Systemic, Cellular and Molecular Neuroscience for Experts

**Programme**
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 6.1 Special Methods in Systemic, Cellular and Molecular Neuroscience for Experts - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 6.2 Special Methods in Systemic, Cellular and Molecular Neuroscience for Experts - Practical Course</td>
<td>SoSe</td>
<td>90 h (6 SWS)</td>
<td>90 h</td>
<td>(6)</td>
</tr>
<tr>
<td>Seminar</td>
<td>WP 6.3 Special Methods in Systemic, Cellular and Molecular Neuroscience for Experts - Seminar</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 360 hours have to be invested.

**Module type**
Compulsory elective module with mandatory courses

**Usability of the module in other Programmes**
None

**Elective guidelines**
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be chosen. By choosing the compulsory elective field "Systemic, Cellular and Molecular Neuroscience ", the compulsory elective modules WP 2, WP 3 and WP 6 must be taken.

**Entry requirements**
None

**Semester**
Recommended Semester: 2

**Duration**
The completion of the module takes 1 Semester.

**Content**
Theoretical and practical knowledge in molecular mechanisms of neurogenesis, neuronal differentiation, circuit formation, synaptogenesis, signal transduction and plasticity.

**Learning outcomes**
Goal of this module is to obtain secure fundamental knowledge in theory and methods of molecular neurobiology.
<table>
<thead>
<tr>
<th><strong>Type of examination</strong></th>
<th>Written exam and presentation</th>
<th><strong>Type of assessment</strong></th>
<th>The successful completion of the module will be graded.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements for the gain of</strong></td>
<td>ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.</td>
<td><strong>ECTS credits</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Responsible contact</strong></td>
<td>Dr. Giacomo Masserdotti</td>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed course information is provided as handout.</td>
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</table>
## Module: WP 7 Machine Learning and Analysis of Neural Data

### Programme

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

### Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 7.1 Machine Learning and Analysis of Neural Data - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 7.2 Machine Learning and Analysis of Neural Data - Practical Course</td>
<td>SoSe</td>
<td>45 h (3 SWS)</td>
<td>135 h</td>
<td>(6)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 270 hours have to be invested.

### Module type

Compulsory elective module with mandatory courses

### Usability of the module in other Programmes

Other related MSc programs

### Elective guidelines

With regard to the compulsory elective fields “Systemic, Cellular and Molecular Neuroscience” and “Computational Neuroscience”, one compulsory elective field must be chosen. By choosing the compulsory elective field “Computational Neuroscience”, the compulsory elective modules WP 1, WP 4, WP 5, WP 7 and WP 8 must be taken.

### Entry requirements

None

### Semester

Recommended Semester: 2

### Duration

The completion of the module takes 1 semester.

### Content

The lecture builds on WP4 and WP5 and aims to provide an overview of important advanced data-analysis methods derived from neuroscientific principles and/or applied in neuroscience. The following topics will be covered: Perceptron and linear separability, logistic regression, cross validation, multilayer networks, backpropagation, empirical risk minimization, regression, density estimation, regularization, support-vector machines, optimization with constraints, kernel trick, bootstrapping, clustering, Bayesian networks, hidden Markov models, dimensionality-reduction techniques, time-series-analysis methods (multitaper estimators, wavelet decomposition, multivariate spectral estimators, hybrid time series), circular statistics.

In the exercise, the students will solve substantial mathematical and programming problems that help them to

| Learning outcomes | The students will be able to understand the functioning and applicability of important advanced data-analysis methods derived from neuroscientific principles and/or applied in neuroscience, and be able to interpret results derived with these methods. The students will be able to apply the most important advanced data analytical methods derived from neuroscientific principles and/or applied in neuroscience. They will also learn to communicate the outcomes of their work to experimental and computational neuroscientists. |
| Type of examination | Written exam and presentation |
| Type of assessment | The successful completion of the module will be graded. |
| Requirements for the gain of ECTS credits | ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully. |
| Responsible contact | Prof. Christian Leibold |
| Language(s) | English |
| Additional information | None |
Module: WP 8 Mathematical Models of Neural Systems and Cognitive Functions

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 8.1 Mathematical Models of Neural Systems and Cognitive Functions - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>0 h</td>
<td>(1)</td>
</tr>
<tr>
<td>Exercise</td>
<td>WP 8.2 Mathematical Models of Neural Systems and Cognitive Functions - Practical Course</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Compulsory elective module with mandatory courses

Usability of the module in other Programmes
Other MSc programs

Elective guidelines
With regard to the compulsory elective fields "Systemic, Cellular and Molecular Neuroscience" and "Computational Neuroscience", one compulsory elective field must be choosen. By choosing the compulsory elective field "Computational Neuroscience", the compulsory elective modules WP 1, WP 4, WP 5, WP 7 and WP 8 must be taken.

Entry requirements
None

Semester
Recommended Semester: 2

Duration
The completion of the module takes 1 semester.

Content
The lecture builds on WP4 and WP5 and aims to provide an overview and fundamental understanding of a selection of advanced models and methods from computational neuroscience. The following topics will be addressed: Attractor models (Fixed-point, sequences, and continuous attractors) and applications, neural network oscillations, modelling decision making, Hebbian learning and receptive-field formation, population coding in vision, decoding dynamic auditory and visual scenes.

In the exercise, the students will solve mathematical and programming problems that help them to more deeply understand and critically discuss topics of the lecture: Attractor models (Fixed-point, sequences, and continuous attractors) and applications, neural network oscillations,
modelling decision making, Hebbian learning and receptive-field formation, population coding in vision, decoding dynamic auditory and visual scenes.

<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>The students will be able to integrate knowledge from experimental and theoretical neuroscience. They will be able apply to apply this knowledge to evaluate experimental findings and to critically assess the outcome of modeling studies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of examination</td>
<td>Written exam</td>
</tr>
<tr>
<td>Type of assessment</td>
<td>The successful completion of the module will be graded.</td>
</tr>
<tr>
<td>Requirements for the gain of ECTS credits</td>
<td>ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully. The students will be able to use mathematical and computational methods to solve advanced problems in theoretical neuroscience and communicate their findings to experimental and computational neuroscientists.</td>
</tr>
<tr>
<td>Responsible contact</td>
<td>Prof. Christian Leibold</td>
</tr>
<tr>
<td>Language(s)</td>
<td>English</td>
</tr>
<tr>
<td>Additional information</td>
<td>None</td>
</tr>
</tbody>
</table>
# Module: WP 9 Systems Neuroscience II

## Programme

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

## Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 9.1 Systems Neuroscience 2 - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
<tr>
<td>Seminar</td>
<td>WP 9.2 Systems Neuroscience 2 - Seminar</td>
<td>SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

## Module type

Compulsory elective module with mandatory courses

## Usability of the module in other Programmes

Other MSc programs

## Elective guidelines

With regard to the compulsory elective modules WP 9 and WP 10, one compulsory elective must be taken.

## Entry requirements

None

## Semester

Recommended semester: 2

## Duration

The completion of the module takes 1 semester.

## Content

This series of lectures offers detailed insight into the fundamentals underlying mammalian - including human - vision and hearing. The lectures cover a wide range of topics including basics, main neuronal structures and processing principles within the visual and auditory pathway as well as interesting psychophysical phenomena.

## Learning outcomes

Knowledge of principles of auditory and visualneuronal processing including behavioural consequences. The students should be able to outline these basic principles and transfer their knowledge into an exam situation. Students will obtain the fundamental knowledge required to participate in further specialized courses of the Master Program and will acquire the basic knowledge prerequisite to physiological research.

## Type of examination

Written exam and presentation

## Type of assessment

The successful completion of the module will be graded.

## Requirements for the gain of ECTS credits

ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed.
successfully.

<table>
<thead>
<tr>
<th><strong>Responsible contact</strong></th>
<th>Prof. Oliver Behrend</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed schedule of topics and dates and lecture handouts are available at the LMU Online directory and accessible for registered students.</td>
</tr>
</tbody>
</table>
Module: WP 10 Biomedical Neuroscience

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 10.1 Biomedical Neuroscience - Lecture</td>
<td>SoSe</td>
<td>30 h (2 SWS)</td>
<td>30 h</td>
<td>(2)</td>
</tr>
<tr>
<td>Seminar</td>
<td>WP 10.2 Biomedical Neuroscience - Seminar</td>
<td>SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Compulsory elective module with mandatory courses

Usability of the module in other Programmes
Other MSc programs

Elective guidelines
With regard to the compulsory elective modules WP 9 and WP 10, one compulsory elective must be taken.

Entry requirements
None

Semester
Recommended Semester: 2

Duration
The completion of the module takes 1 semester.

Content
The lecture offers a comprehensive introduction to clinical research in the neurosciences. It covers basic aspects not included in the standard neuroscience curriculum, including methods specific to clinical neuroscience. The last part of the lecture introduces the students to the important topic of clinical trials and their specific considerations.

Topics are:
(1) basics: functional neuroanatomy, pathophysiology, pharmacology, epidemiology, neuropsychology;
(2) methods: principles of experimental research with patients, imaging, therapeutic principles, statistics;
(3) clinical trials: planning, ethical and legal aspects, recruitment, documentation, data management and analysis

The seminar covers original publications related to the topics of the lecture.

Learning outcomes
Based on Fundamental Neuroscience, the students will learn specific aspects of Biomedical Neuroscience including Clinical aspects of neurological diseases and therapeutic advances based on Translational Neuroscience.
<table>
<thead>
<tr>
<th><strong>Type of examination</strong></th>
<th>Written exam and presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of assessment</strong></td>
<td>The successful completion of the module will be graded.</td>
</tr>
<tr>
<td><strong>Requirements for the gain of ECTS credits</strong></td>
<td>ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.</td>
</tr>
<tr>
<td><strong>Responsible contact</strong></td>
<td>Dr. Valerie Kirsch</td>
</tr>
<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>Detailed schedule of topics and dates and lecture handouts are available at the LMU Online directory and accessible for registered students.</td>
</tr>
</tbody>
</table>
Module: P 8 Lab Rotation

Programme
Master’s Programme: Neurosciences
(Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>P 8.1 Laboratory Internship</td>
<td>WiSe</td>
<td>45 h (3 SWS)</td>
<td>15 h</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SoSe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar</td>
<td>P 8.2 Lab Rotation - Seminar</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
The students choose a lab and research topic based on their own interest. It is recommended to study the research expertise of faculty members as available on our homepage: http://www.mcn.uni-muenchen.de/members

Entry requirements
None

Semester
Recommended semester: 3

Duration
The completion of the module takes 1 semester.

Content
The students participate in different methodological activities in a chosen lab.

Learning outcomes
Insight into organization, experimental setups, analyzing data and discussions in order to investigate neuroscientific questions.

Type of examination
Report or presentation

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact
Members of the faculty of the Graduate School of Systemic Neurosciences
<table>
<thead>
<tr>
<th>Language(s)</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional information</td>
<td>None</td>
</tr>
</tbody>
</table>
Module: P 9 Research Project III

Programme

Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical course</td>
<td>P 9.1 Research Project 3 - Practical Course</td>
<td>WiSe</td>
<td>75 h (5 SWS)</td>
<td>75 h</td>
<td>(5)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 9.2 Research Seminar - Special Topics in Neurosciences</td>
<td>WiSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 180 hours have to be invested.

Module type

Mandatory module with mandatory courses

Usability of the module in other Programmes

None

Elective guidelines

The students choose a lab and research topic based on their own interest. It is recommended to study the research expertise of faculty members as available on our homepage: http://www.mcn.uni-muenchen.de/members

Entry requirements

None

Semester

Recommended semester: 3

Duration

The completion of the module takes 1 semester.

Content

Content of this research project is guided work on a scientific question from the field of systems neurobiology.

Learning outcomes

Goal of this research project is gaining practice in elementary skills of scientific working and good laboratory practice.

Type of examination

Report and presentation

Type of assessment

The successful completion of the module will be graded.

Requirements for the gain of ECTS credits

ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact

Members of the faculty of the Graduate School of Systemic Neurosciences

Language(s)

English
Additional information: None
Module: P 10 Teaching and Training

Programme

Master's Programme: Neurosciences
(Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorial</td>
<td>P 10.1 Tutoring for Beginners</td>
<td>WiSe and SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
<tr>
<td>Workshop</td>
<td>P 10.2 Non-Scientific Skills</td>
<td>WiSe and SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
<tr>
<td>Workshop</td>
<td>P 10.3 Vocational Training</td>
<td>WiSe and SoSe</td>
<td>15 h (1 SWS)</td>
<td>15 h</td>
<td>(1)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
The tutorial is scheduled and organized by the students. The Non-Scientific Skills workshops are announced at the GSN homepage: http://www.gsn.uni-muenchen.de/seminars_events/workshops

Entry requirements
None

Semester
Recommended semester: 3

Duration
The completion of the module takes 2 semester.

Content
Contents of this module are specialized complementary skills e.g. teaching as well as social, lingual and time management skills.

Learning outcomes
The students will learn to organize and perform training for fellow students. The Scientific Skills Workshops prepare the student for different career demands.

Type of examination
Presentation

Type of assessment
The successful completion of the module will not be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact
Dr. Alexander Kaiser

Language(s)
English
Additional information  None
Module: WP 11-14 Interdisciplinary and Advanced Topics in Neurosciences I-IV

### Programme
Master's Programme: Neurosciences (Master of Science, M.Sc.)

### Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>WP 11.1 Interdisciplinary Training 1 - Lecture</td>
<td>WiSe and SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

### Module type
Compulsory elective module with mandatory course

### Usability of the module in other Programmes
None

### Elective guidelines
With regard to the compulsory elective modules WP 11 - WP 22, four compulsory elective modules must be taken.

The students select courses from a list of courses on their own interest. The available courses are listed in the LMU online directory (LSF).

### Entry requirements
None

### Semester
Recommended semester: 3

### Duration
The completion of the module takes 1 semester.

### Content
Contents of this module are additional theoretical and practical skills in the scientific field of individual interest, and interdisciplinary scientific discussions.

### Learning outcomes
The students will learn to focus on their own scientific profile. Furthermore the students gain practice integrating insights from different fields on a common topic and enhance their ability to take part in interdisciplinary discussions.

### Type of examination
Written exam

### Type of assessment
The successful completion of the module will be graded.

### Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
<table>
<thead>
<tr>
<th><strong>Responsible contact</strong></th>
<th>Members of the faculty of the Graduate School of Systemic Neurosciences</th>
</tr>
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<tbody>
<tr>
<td><strong>Language(s)</strong></td>
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</tr>
<tr>
<td><strong>Additional information</strong></td>
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</table>
Module: WP 15-18 Interdisciplinary and Advanced Topics in Neurosciences V-VIII

Programme
Master’s Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seminar</td>
<td>WP 15.1 Interdisciplinary Training 5 - Seminar</td>
<td>WiSe and SoSe</td>
<td>30 h (2 SWS)</td>
<td>60 h</td>
<td>(3)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Compulsory elective module with mandatory course

Usability of the module in other Programmes
None

Elective guidelines
With regard to the compulsory elective modules WP 11 - WP 22, four compulsory elective modules must be taken.

The students select courses from a list of courses on their own interest. The available courses are listed in the LMU online directory (LSF).

Entry requirements
None

Semester
Recommended semester: 3

Duration
The completion of the module takes 1 semester.

Content
Contents of this module are additional theoretical and practical skills in the scientific field of individual interest, and interdisciplinary scientific discussions.

Learning outcomes
The students will learn to focus on their own scientific profile. Furthermore, the students gain practice integrating insights from different fields on a common topic and enhance their ability to take part in interdisciplinary discussions.

Type of examination
Presentation

Type of assessment
The successful completion of the module will be graded.

Requirements for the gain of ECTS credits
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed.
successfully.

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<td><strong>Additional information</strong></td>
<td>None</td>
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</table>
Module: WP 19-22 Interdisciplinary and Advanced Topics in Neurosciences IX-XII

Programme

Master's Programme: Neurosciences (Master of Science, M.Sc.)

Related module parts

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>WP 19.1 Interdisciplinary Training 9 - Practical Course</td>
<td>WiSe and SoSe</td>
<td>45 h (3 SWS)</td>
<td>45 h</td>
<td>(3)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 3 contact hours. Including time for self-study, 90 hours have to be invested.

Module type

Compulsory elective module with mandatory course

Usability of the module in other Programmes

None

Elective guidelines

With regard to the compulsory elective modules WP 11 - WP 22, four compulsory elective modules must be taken.

The students select courses from a list of courses on their own interest. The available courses are listed in the LMU online directory (LSF).

Entry requirements

None

Semester

Recommended semester: 3

Duration

The completion of the module takes 1 semester.

Content

Contents of this module are additional theoretical and practical skills in the scientific field of individual interest, and interdisciplinary scientific discussions.

Learning outcomes

The students will learn to focus on their own scientific profile. Furthermore the students gain practice integrating insights from different fields on a common topic and enhance their ability to take part in interdisciplinary discussions.

Type of examination

Presentation or report

Type of assessment

The successful completion of the module will be graded.

Requirements for the gain of ECTS credits

ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed.
successfully.

<table>
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<tr>
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</tr>
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<tr>
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<tr>
<td>Additional information</td>
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</tbody>
</table>
Module: P 11 Special Topics in Neurosciences

Programme
Master's Programme: Neurosciences (Master of Science, M.Sc.)

<table>
<thead>
<tr>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colloquium</td>
<td>P 11.1 Special Topics in Neurosciences - Colloquium</td>
<td>WiSe and SoSe</td>
<td>15 h (1 SWS)</td>
<td>30 h</td>
<td>(1,5)</td>
</tr>
<tr>
<td>Seminar</td>
<td>P 11.2 Neurosciences - Research Seminar</td>
<td>WiSe and SoSe</td>
<td>15 h (1 SWS)</td>
<td>30 h</td>
<td>(1,5)</td>
</tr>
</tbody>
</table>

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type
Mandatory module with mandatory courses

Usability of the module in other Programmes
None

Elective guidelines
The students choose a lab and research topic based on their own experience and interest. It is recommended to study the research expertise of faculty members as available on our homepage: http://www.mcn.uni-muenchen.de/members

Entry requirements
None

Semester
Recommended semester: 4

Duration
The completion of the module takes 1 semester.

Content
In addition to prepare and write the master thesis, students have to participate in Research Seminars of the supervisors research group and present the own project.

Learning outcomes
The students will learn about experimental designs, analysis and interpretation of results, good scientific praxis as of DFG guidelines and ethical issues related to Neuroscience Research.

Type of examination
Presentation

Type of assessment
The successful completion of the module will not be graded.

Requirement(s) for the gain of ECTS
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have
<table>
<thead>
<tr>
<th><strong>credits</strong></th>
<th>been completed successfully.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsible</strong></td>
<td>Supervisor of master thesis.</td>
</tr>
<tr>
<td><strong>contact</strong></td>
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<tr>
<td><strong>Language(s)</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Additional</strong></td>
<td>DFG Guidelines for Good Scientific Praxis: <a href="https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice">https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice</a></td>
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</tbody>
</table>
**Module: P 12 Final Module**

**Programme**  
Master’s Programme: Neurosciences  
(Master of Science, M.Sc.)

<table>
<thead>
<tr>
<th>Related module parts</th>
<th>Course type</th>
<th>Course (mandatory)</th>
<th>Rotation</th>
<th>Contact hours</th>
<th>Self-study hours</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Master Thesis</td>
<td>P 12.1 Master Thesis</td>
<td>WiSe and SoSe</td>
<td>-</td>
<td>780 h (26)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disputation</td>
<td>P 12.2 Disputation</td>
<td>WiSe and SoSe</td>
<td>-</td>
<td>30 h (1)</td>
<td></td>
</tr>
</tbody>
</table>

For successful completion of the module, 27 ECTS credits have to be acquired. Including time for self-study, 810 hours have to be invested.

**Module type**  
Mandatory module

**Usability of the module in other Programmes**  
None

**Elective guidelines**  
The students choose a lab and research topic based on their own experience and interest. It is recommended to study the research expertise of faculty members as available on our homepage: [http://www.mcn.uni-muenchen.de/members](http://www.mcn.uni-muenchen.de/members)

**Entry requirements**  
Successful completion of the modules P 1 - P 5 and P7 and successful completion of compulsory elective modules with a total value of 24 ECTS credits from WP 1 - WP 10

**Semester**  
Recommend semester: 4

**Duration**  
The completion of the module takes 1 semester.

**Content**  
Contents of this module is preparing writing the master thesis and presenting the thesis at the disputation.

**Learning outcomes**  
The goal of this module is to transfer the acquired theoretical and methodical knowledge to a given scientific question and to independently interpret individually gained data. Furthermore students shall be able to competently participate and lead scientific discussions.

**Type of examination**  
Master Thesis and disputation

**Type of assessment**  
The successful completion of the module will be graded.

**Requirements for the gain of ECTS**  
ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have
<table>
<thead>
<tr>
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<tbody>
<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>Additional information</td>
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</table>