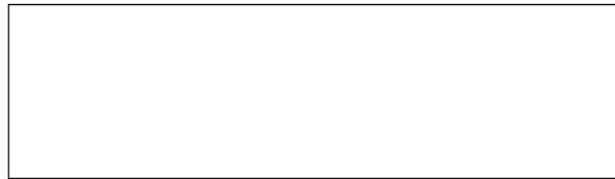




LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN



Module Catalogue
Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

(120 ECTS credits)

Based on the *Prüfungs- und Studienordnung* of 29. November 2019

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Issued on 15 June 2020

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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 course
P	mandatory course

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.

Overarching qualification goals of the master's course Human Biology – Principles of Health and Disease

The focus of the master's course „Human Biology – Principles of Health and Disease“ lies on the interface of medicine and biology. The central qualification goal of the course is to train graduates for research-related, professional activity in the field of biomedicine.

Students who have completed this course have acquired a broad, solid, professional biomedical knowledge. They understand the molecular, cellular and physiological processes and mechanisms both within a healthy human body and in the state of illness. They understand the causes of selected human diseases and the procedures for targeted diagnosis and treatment. In at least two of the five main topics "Cell Biology, Stem Cells and Epigenetics", "Molecular Microbiology and Infection Biology", "Molecular Oncology", "Neuroscience" and "Cardiovascular and Lung Research" they will gain more specific and in-depth specialist knowledge and skills. These are for example: theoretical knowledge and laboratory knowledge about designing experiments or setup within the fields: epigenetics, host-pathogen interactions, immune response, prophylaxis of infections, characteristics of cancer, neuroanatomy, optogenetics and diseases of the nervous system heart, lung and metabolic disorders.

Graduates are able to read, to analyze, to describe and to interpret biomedical primary literature such as create hypothesis about biomedical questions independently. They are also able to recognize, to understand, to analyze and to explain contexts within the biomedical research.

Graduates have learned all common laboratory methods to independently deal with questions from basic biomedical and applied research. They can safely apply and carry out these methods for specific questions in biomedical research, as well as analyze problems that arise and adapt existing methods to new questions. The laboratory methods mastered by the graduates include, for example, RNA and DNA extraction, DNA amplification using PCR, cloning methods, electrophoresis techniques, transfection and transformation approaches, methods of protein isolation, purification and characterization, western blotting, immunoassay and cell culture methods. They have in-depth knowledge of the common model organisms and how to use them in biomedical questions. In addition, the graduates know the function of the most processed microscopy techniques in biomedical research. They know how to use and evaluate imaging methods in biomedical research. Graduates know how to correctly carry out and log the laboratory methods based on safety and procedural instructions.

In parallel to the laboratory methods that generate results, the graduates can use the common evaluation methods and software programs from the field of biomedicine to analyze the data, assess the results and derive new questions from them.

The evaluation also includes processing and validating the data using the appropriate statistical methods; in addition, they can visualize and present the results in written and oral form.

In addition to the professional skills, the graduates have also acquired all the necessary general skills for qualified employment and the ability to engage in society. Graduates of the master's degree have trained analytical thinking skills. They have a clear judgment about practical research skills and knowledge of methods and concepts of scientific research. Graduates can critically classify and assess scientific findings from biomedicine and they are able to discuss this in technical vocabulary with colleagues.

Graduates are able to understand specific biomedical questions independently, to do research on information, to create hypotheses independently, to design, plan and safely carry out corresponding research projects either alone or with others. Graduates are able to present their results and to discuss and evaluate them in a simple language with other scientists and with members of society. They have their own ethical awareness and values regarding the subject areas of the study program. They are empowered to take on management functions and to act in responsible manner. Based on this background, graduates can deal competently with questions from the fields of biomedical research at universities, research institutes and industry, in public authorities and in public and private companies.

Module: P 1 Labormethoden der Biomedizin/Lab methods in Biomedical Sciences

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	P 1.1 Übung Labormethoden der Biomedizin/Practical course Lab methods in Biomedical Sciences	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	P 1.2 Seminar Labormethoden der Biomedizin/Seminar Lab methods in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	<ul style="list-style-type: none"> • RNA Extraction • RT-PCR • PCR • Cloning • Miniprep • gel electrophoresis • <i>E.coli</i> transformation • transfection • plant transformation • fluorescence microscopy • protein extraction • Co-immunoprecipitation • Western blotting • Model organisms: <i>E.coli</i>, mouse and human cell culture, <i>Arabidopsis</i> and <i>N. benthamiana</i>, <i>C. elegans</i>

Learning outcomes	<ul style="list-style-type: none">• Molecular and cellular biology techniques: safe handling with the help of established protocols• Writing of scientific reports based on journal guidelines• Analysis and interpretation of figures using image softwares• scientific presentation
Type of examination	Written 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 elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Heinrich Leonhardt
Language(s)	English
Additional information	None

Module: P 2 Datenanalyse und Bioinformatik/Data Analysis and Bioinformatics

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 2.1 Vorlesung Datenanalyse und Bioinformatik/Lecture Data Analysis and Bioinformatics	WiSe	30 h (2 SWS)	60 h	(3)
Practical course	P 2.2 Übung Datenanalyse und Bioinformatik/Practical course Data Analysis and Bioinformatics	WiSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	<ul style="list-style-type: none"> • Literature search and evaluation (Web of science, PubMed, Google Scholar and journal websites) • Literature Managment (Endnote) • Citations and Plagiarism • Protein function prediction (homology based searches, protein localization prediction, post-translational modification prediction, structural predictions) • CLC (sequence analysis, primer design, in silico cloning) • Phylogenetic analysis (basic concepts for evolution, the basics of building and interpreting phylogenies) • Protein modelling (chimera) • Image J/ Fiji (image preparation and quantification)

Basics of the statistical programming language R

Learning outcomes	<ul style="list-style-type: none">• Safe usage of basic computational biology tools• Basic understanding of the underlying computational principles• Understanding of the evaluation criteria used for these bioinformatic tools• Understanding of potential applications of the shown bioinformatic tools
Type of examination	Written exam 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 elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Martin Parniske
Language(s)	English
Additional information	Login in Moodle. Course: Computational Biology

Module: P 3 Bioimaging

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	P 3.1 Übung Bioimaging/Practical course Bioimaging	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	P 3.2 Seminar Bioimaging	WiSe	30 h (2 SWS)	60 h	(3)

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

Master's Programmes:
Molecular and Cellular Biology; Plant Sciences;
Evolution, Ecology and Systematics

Elective guidelines

None

Entry requirements

None

Semester

Scheduled semester: 1

Duration

The completion of the module takes 1 semester.

Content

This module builds on Bachelors's level and aims to significantly deepen and expand knowledge of the basics and application of optical microscopic imaging in (medical) biology. The whole microscopic workflow from sample preparation, imaging to data analysis is addressed: Samples are prepared from cultured cells as well as cryosections stained by immunohistochemistry or organic dyes. In the imaging part the module starts with optical microscopy basics, principles of contrast, signal to noise ratio and ends with advanced optical microscopy technologies. Image processing and quantification with open source as well as dedicated commercial software are also part of this module. Emphasis will be placed on applications of basic and advanced optical methods with hands-on experience, and the integration of bioimaging into science and best practices in scientific imaging will be highlighted.

Learning outcomes

The students will understand the strengths and weaknesses of the most widely used microscopy modalities and will gain sufficient background to correctly apply it for scientific imaging in (medical)

biology. Moreover, the gained hands-on experience in sample preparation, basic and advanced microscopic modalities, and image data analysis will further support the students when taking the first steps of utilizing microscopy in their future career.

Type of examination	Written 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 elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Heinrich Leonhardt, Prof. Christian Weber
Language(s)	English
Additional information	None

Module: P 4 Modellorganismen/Model Organisms

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	P 4.1 Übung Modellorganismen/Practical course Model Organisms	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	P 4.2 Seminar Modellorganismen/Seminar Model Organisms	WiSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	<p>The module will cover selected topics to elucidate how model organism has lead scientists to uncover groundbreaking biological concepts in the field of molecular, cell biology and biomedical sciences.</p> <p>This module aims to introduce typical biomedical model organisms and compare their strengths and weaknesses for scientific approaches.</p> <p>For the seminar, students will prepare a presentation based on current publications about the below metioned model organisms. Advantages and disadvantages will be discussed in the group. The seminars will also complement gaps of recent research breakthroughs, which cannot be covered in the practical course.</p> <p>The practical course covers the following model organisms for biomedical reasons:</p> <ul style="list-style-type: none"> • Bacteria and phages Students will work with bacteria (laboratory strains and environmental isolates) and with phages. They will get training in basic and advanced methods in microbiology

such as phage transfection, various chemotaxis assays and their use in identifying mutants.

- Yeast
Evolutionary concepts in mitochondrial biology will be discussed and studied. A focus will be laid on mitochondrial morphology and dynamics.
- *C. elegans*
The topics will span from molecular pathways involved in cell polarity to centrosome function of microcephaly linked proteins.
- *Danio rerio*
State of the art methods, breeding, legislation in biomedical sciences
- *Xenopus laevis*
Focus on the expression and electrophysiological analysis of ligand-gated ion channels in *Xenopus* oocytes.
- Mouse
The focus is on mouse models for hypertension, asthma and pulmonary fibrosis. We will prepare aortic and tracheal rings to quantify contraction after pharmacological intervention as well as isolate primary murine lung fibroblasts.
- β -Cell lines
The students will learn the advanced research methodologies to investigate function of the pancreatic beta cells and will significantly expand their knowledge in the area of novel therapeutic options for the treatment of the patient with type 2 diabetes.
Pancreatic beta cell culture, stimulation and investigation of insulin secretion via sandwich ELISA are the main methods in this practical course.

Learning outcomes

Students will be introduced in seven model organisms theoretically and practically. They will deepen their insights into model organisms. Through the practical course students will have the opportunity to test state of the art techniques used in the different fields. Students will know strengths and weaknesses of existing model organisms and should be able to select appropriate models for a given scientific question.

In the seminar, single students will learn to prepare and present a presentation summarizing and explaining applications of the model systems based on the given literature as well as discussing critically within a group.

Type of examination

Written 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 elective compulsory module parts) has/have been completed successfully.

Responsible contact Prof. Dr. Thomas Gudermann, Prof. Dr. Kirsten Jung

Language(s) English

Additional information Literature:
e.g. Zebrafish:
Monte Westerfield, The Zebrafish Book. Online at:
https://zfin.org/zf_info/zfbook/zfbk.html
The Zebrafish Information Network. Online at
<http://www.zfin.org>

Module: P 5 Aktuelle Themen der biomedizinischen Forschung/Current topics in Biomedical Sciences

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 5.1 Vorlesung Aktuelle Themen der biomedizinischen Forschung/Lecture Current topics in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)
Seminar	P 5.2 Seminar Aktuelle Themen der biomedizinischen Forschung/Seminar Current topics in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Scheduled semester: 1
Duration	The completion of the module takes 1 semester.
Content	<p>This module was designed to provide students with an introduction to all five main topics of their study programme.</p> <p>The lecture series "Current topics in biomedical sciences" focuses on how molecules, cells, organs and systems function in the human body, which is highly relevant to the understanding and treatment of human diseases. Students will meet 14 professors of the Medical Faculty and the Faculty of Biology and learn about their current research topics and challenges and the theory behind them. For the seminar, each student will prepare a presentation of current scientific publications which are milestones within the five main topics and/or which are written by the research groups of the aforementioned professors. Based on the research background of the professors following exemplary topics are addressed for each main topic:</p>

- Cell Biology, Stem Cells & Epigenetics
"DNA modifications in development, aging and disease"
"Comparative primate genomics, single-cell genomics and the human cell atlas"
"Ion channels as new therapeutic targets"
- Microbiology, Infection & Immunology
"Helicobacter pylori: A carcinogenic human pathogen and paradigm for studying bacterial population structure and genome variation"
"Exotic mechanisms of signaling and gene expression in trypanosomatid protozoa: a glimpse of evolution and an opportunity for antiparasitic drug development. "
"Bacterial Signaling"
"Pandemic viruses in a changing world: challenges and promises"
"Dendritic Cells control Tolerance and Immunity"
- Neurosciences
"Neural Basis of spatial navigation"
"Imaging immune-mediated nervous system damage"
"Challenges in Translational Neurosciences - from Brain Computer Interfaces to Neuronal Repair"
- Molecular Oncology
"Harnessing T cells for cancer immunotherapy"
"Principles of tumor immunotherapy"
- Cardiovascular- and Lung Research
"Cardiovascular Research – from preclinical models to human studies"

Learning outcomes	Students will familiarize themselves with the current research facts in the five main topics, they will acquire a necessary basic knowledge for the next semesters. Upon the completion of the seminar series, each student will know how to prepare and present a presentation summarizing and explaining applications based on the given literature of the five main topics as well as how to discuss critically within a group.
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 elective compulsory module parts) has/have been completed successfully.

Responsible contact Prof. Dr. Thomas Gudermann,
Prof. Dr. Heinrich Leonhardt

Language(s) English

Additional information None

Module: P 6 Schlüsselqualifikationen I/Soft Skills I

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	P 6.1 Schlüsselqualifikationen I/Soft Skills I	SoSe	30 h (2 SWS)	60 h	(3)

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 course
Usability of the module in other Programmes	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	This module contains courses which equip students for their future career with necessary skills besides their biological knowledge. This could be courses e.g. about time management, self-organization, leadership, language and communication skills, entrepreneurship as well as internships in companies about marketing, human resources, management or administration.
Learning outcomes	At the end of the module each student will have a realistic perspective of the future work expectations regarding the soft skills. The objectives are to help students gain good self-positioning, self-reflection and self-organization, an understanding how to be a good communicator and listener with problem-solving skills in a modern work environment.
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 elective compulsory module parts) has/have been completed successfully.

Responsible contact

Spokespersons, Dean of studies, teaching staff of the different courses

Language(s)

English

Additional information

None

Module: WP 1 Zellbiologie, Stammzellen und Epigenetik I/Cell Biology, Stem Cells and Epigenetics I

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 1.1 Vorlesung Zellbiologie, Stammzellen und Epigenetik/Lecture Cell Biology, Stem Cells and Epigenetics	SoSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 1.2 Übung Zellbiologie, Stammzellen und Epigenetik/Practical course Cell Biology, Stem Cells and Epigenetics	SoSe	45 h (3 SWS)	45 h	(3)
Seminar	WP 1.3 Seminar Zellbiologie, Stammzellen und Epigenetik/Seminar Cell Biology, Stem Cells and Epigenetics	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 7 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 1 and WP 2, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	<p>Main focus of this module is to understand the biology of ES cells, including pluripotency and their ability to differentiate into the 3 germ layers. Moreover, ES cells are on the only cells that can tolerate a complete loss of methylation, providing a perfect tool to study epigenetic events that naturally happen during embryogenesis. Content will be presented and discussed in lecture (3ECTS).</p> <p>Leading up to the practical course, Students will work in teams and design their own experiments together with the course</p>

instructors. Experiments will be discussed and presented in a seminar (3 ECTS). After validation of these presented and suggested experiments, the students will practically perform these designed experiments within the 3 weeks of the course (3 ECTS). Students will learn how design experiments based on current literature, how to validate feasibly and how to actually perform them in the lab. Students can apply theoretical and practical knowledge to approach biological questions in independent work. Students will obtain skills for future lab work in the field of epigenetics and embryonic stem cells, in particular in preparation for their lab rotations and master's thesis. Emphasis is placed on the independent design of an experiment and on hands-on practice with the techniques mentioned above. The course entails 6 SWS and requires a detailed lab report according to excellent scientific practice.

Lab Work (depending on the experimental set up)

- Cell culture handling of embryonic stem cells
- Differentiation techniques
- RNA and DNA extraction methods
- RT-PCR
- Semi-quantitative Western Blot
- Quantitative Real Time PCR
- Analysis of expression levels of mRNA and proteins
- Methylation analysis (COBRA)
- Immunostaining
- Fluorescencemicroscopy
- Data analysis and presentation
-

Learning outcomes

Qualification goals: Students can apply theoretical and practical knowledge to approach biological questions in independent work. Students obtain skills for future lab work in the field of epigenetics in preparation for future lab work and master's thesis.

Skills

- Independent assay design and experimental set up
- molecular and cellular biology techniques: safe handling with the help of established protocols
- writing of scientific reports based on journal guidelines
- practice critical evaluation and interpretation of data as a basis for careful and relevant conclusions
- generating figures using image software
- scientific presentation
- written data presentation
- documentation, interpretation and discussion of the results
- social skills (teamwork, mutual respect)
- cooperation
- fair play

- work delegation
- communication skills: rapport with instructors and fellow students, presentations, written lab reports
- organizational skills: efficient planning, documentation

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. Heinrich Leonhardt, Dr. Daniela Meilinger
Language(s)	English
Additional information	none

Module: WP 2 Molekulare Mikrobiologie und Infektionsbiologie I/Molecular Microbiology and Infection Biology I

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 2.1 Vorlesung Molekulare Mikrobiologie und Infektionsbiologie/Lecture Molecular Microbiology and Infection Biology	SoSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 2.2 Übung Molekulare Mikrobiologie und Infektionsbiologie/Practical course Molecular Microbiology and Infection Biology	SoSe	45 h (3 SWS)	45 h	(3)
Seminar	WP 2.3 Seminar Molekulare Mikrobiologie und Infektionsbiologie/Seminar Molecular Microbiology and Infection Biology	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 7 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 1 and WP 2, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	<u>Lecture:</u> This lecture series is taught by several experts to cover the fields of Molecular and Medical Microbiology, Virology and Immunology. Topics will include physiology and regulation of bacteria of the human microbiome, host-pathogen interaction, basic immunology principles, immune responses and tolerance as well as immunology in health and disease, and present experimental and conceptual paradigms of infection biology focussing on selected highly relevant and topical bacterial and viral

infections. Infections covered will be selected to represent both acute and chronic infections and include diverse pathogens highlighting the most relevant strategies of human pathogens to achieve infections.

Seminar: Every student will present a seminar on the basis of an assigned topic and at least one recent and comprehensive review article. Seminars will have an overarching thematic context. The seminars will also complement gaps of recent research breakthroughs, which cannot be covered in the lecture series.

Practical course: The practical courses are taught by experts to cover the fields of Molecular and Medical Microbiology, Virology and Immunology. Students will work with bacteria, viruses, viral vectors and a variety of cell types, including immune cells. They will get training in a large variety of methods and protocols, including handling of radioactively labelled tracers, basic and advanced immunological methods, assays typically used in infection biology, such as bacterial and viral proliferation assays, infection assays, reporter systems and cell culture-based methods.

Learning outcomes	<p>At the end of the lecture series students will have acquired the competence to recognize paradigms in host-pathogen interactions, to understand basic principles of the immune response and to recognize fundamental approaches to therapies and anti-infective prophylaxis.</p> <p>Upon the completion of the seminar series, students will be competent to present ground-breaking research in the area and to moderate a discussion session.</p> <p>During the practical course the students will learn various methods and apply them to solve focussed research questions. They will deepen their insights into model organisms and systems. Students will be prepared for their future research in lab rotations and the master thesis, and will acquire the basic competence of solving research questions in the laboratory setting. They will also acquire the basic skills of safety handling pathogenic agents.</p>
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. Dr. Kirsten Jung, Prof. Dr. Sebastian Suerbaum
Language(s)	English

Additional information

Madigan, (2018) Brock Biology of Microorganisms, Global Edition, 15th edition. Pearson.

Slonczewski and Foster (2016) Microbiology an Evolving Science, 4th edition. W.W Norton and Company.

Module: WP 3 Zellbiologie, Stammzellen und Epigenetik II/Cell Biology, Stem Cells and Epigenetics II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 3.1 Forschungspraktikum Zellbiologie, Stammzellen und Epigenetik/Research course Cell Biology, Stem Cells and Epigenetics	SoSe	180 h (12 SWS)	120 h	(10)
Seminar	WP 3.2 Begleitendes Seminar Zellbiologie, Stammzellen und Epigenetik/Accompanying seminar Cell Biology, Stem Cells and Epigenetics	SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 13 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 3 and WP 4, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	<p>Research projects related to cancer epigenetics, stem cell biology & epigenetic events in differentiation processes, Antibody-Drug Conjugates, Antibody Generation and Advanced High-Resolution Microcopy.</p> <p>Course Contents: 8-week research project Student project is based on current and latest research and designed closely with the direct supervisor in the lab (PostDoc, PhD student) experience the daily life of scientific research this includes working in the lab under supervision and as soon as ready students are expected to work independently</p>

joining lab meetings and discussions
 independent literature research
 design of a research schedule
 document, interpret and discuss the results of experiments
 in scientific language
 documentation in a lab journal
 analysis of experiments
 presentation of the research project both orally (mins talk
 during the lab meeting) and in written form (lap report)

Learning outcomes	<p>Skills: Students who successfully completed this module are able to...</p> <ul style="list-style-type: none"> • work on a complex research project • strengthen practical lab skills to be able to work independently • independently design and perform small scientific projects related to the topic of the module on a professional level • address scientific questions experimentally and analyze experimental results • apply the learning contents and skills from pre-connected modules and deepen their knowledge in the specific topic of the research group
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	All Professors from the main topic "Cell Biology, Stem Cells and Epigenetics"
Language(s)	English
Additional information	<p>e.g. Research Overview: http://www.bioimaging.bio.lmu.de/research/index.html Recent Publications http://www.bioimaging.bio.lmu.de/publications/index.html Cancer Evolution SFP: https://www.sfb1243.biologie.uni-muenchen.de/index.html</p>

Module: WP 4 Molekulare Mikrobiologie und Infektionsbiologie II/Molecular Microbiology and Infection Biology II

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 4.1 Forschungspraktikum Molekulare Mikrobiologie und Infektionsbiologie/Research course Molecular Microbiology and Infection Biology	SoSe	180 h (12 SWS)	120 h	(10)
Seminar	WP 4.2 Begleitendes Seminar Molekulare Mikrobiologie und Infektionsbiologie/Seminar Molecular Microbiology and Infection Biology	SoSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 13 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 3 and WP 4, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	8 full time weeks in the laboratory. The students have to choose a research group for the internship. They will conduct a project of their own, guided by a supervisor. During the internship, the students will participate in the seminar of the research group or the institute in which they conduct their research internship and at the end, they also have to present a seminar (written protocol -10-15 pages- and an oral presentation (30 min).
Learning outcomes	The students will be able to integrate knowledge and deal with the complexity of Molecular Microbiology and Infection Biology. They will learn different protocols and techniques,

how to analyze results, formulate postulates/conclusions and to make decisions based on the previous results. The students will be able to communicate their conclusions in a clear manner and to exchange information and ideas on a scientific level.

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	All Professors from the main topic Molecular Microbiology and Infection Biology
Language(s)	English
Additional information	Madigan, (2018) Brock Biology of Microorganisms, Global Edition, 15th edition. Pearson. Slonczewski and Foster (2016) Microbiology an Evolving Science, 4th edition. W.W Norton and Company. Specific scientific articles related to the topic.

Module: WP 5 Vertiefende Themen in der Biomedizin/Advanced topics in Biomedical Sciences

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 5.1 Vorlesung Vertiefende Themen in der Biomedizin/Lecture Advanced topics in Biomedical Sciences	SoSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken. Please refer to the elective course catalogue for the master programme Human Biology – Principles of Health and Disease.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Written exam
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 Please refer to the elective course catalogue for the master programme.

Language(s) English

Additional information None

Module: WP 6 Vertiefende Konzepte in der Biomedizin/Advanced concepts in Biomedical Sciences

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 6.1 Vorlesung Vertiefende Konzepte in der Biomedizin/Lecture Advanced concepts in Biomedical Sciences	SoSe	30 h (2 SWS)	60 h	(3)

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 courses
Usability of the module in other Programmes	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken. Please refer to the elective course catalogue for the master programme Human Biology – Principles of Health and Disease.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Written exam
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

Please refer to the elective course catalogue for the master programme.

Language(s)

English

Additional information

None

Module: WP 7 Vertiefende Methoden in der Biomedizin I/Advanced methods in Biomedical Sciences I

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 7.1 Übung Vertiefende Methoden in der Biomedizin 1/Practical course Advanced methods in Biomedical Sciences 1	SoSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Report
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	Please refer to the elective course catalogue for the master programme.
Language(s)	English
Additional information	None

Module: WP 8 Vertiefende Methoden in der Biomedizin II/Advanced methods in Biomedical Sciences II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 8.1 Übung Vertiefende Methoden in der Biomedizin 2/Practical course Advanced methods in Biomedical Sciences 2	SoSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Report
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

Please refer to the elective course catalogue for the master programme.

Language(s)

English

Additional information

None

Module: WP 9 Aktuelle Publikationen zu vertiefenden Forschungsthemen in der Biomedizin/Current publications on advanced research topics in Biomedical Sciences

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 9.1 Seminar Aktuelle Publikationen zu vertiefenden Forschungsthemen in der Biomedizin/Seminar Current publications on advances research topics in Biomedical Sciences	SoSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
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

Please refer to the elective course catalogue for the master programme.

Language(s)

English

Additional information

None

Module: WP 10 Aktuelle Publikationen zu vertiefenden Methoden in der Biomedizin/Current publications on advanced methods in Biomedical Sciences

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 10.1 Seminar Aktuelle Publikationen zu vertiefenden Methoden in der Biomedizin/Seminar Current publications on advanced methods in Biomedical Sciences	SoSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
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

Please refer to the elective course catalogue for the master programme.

Language(s)

English

Additional information

None

Module: WP 11 Grundlagen der Ethik/Basics of Ethics

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 11.1 Seminar Grundlagen der Ethik/Seminar Basics of Ethics	SoSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	This module provides an introduction to ethics in health sciences. Students will learn about the history and principles of ethics of scientific research, medicine and healthcare research. Regarding the supervisor special emphasis will be given to social and global justice in healthcare or to the ethics of human enhancement.
Learning outcomes	At the end of the module students will have an understanding of the basics of ethics and ethical thinking. The student can identify and discuss critically ethical issues in everyday life, medicine, health care and life science.
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	Spokespersons, Dean of Studies, Munich Center of Ethics of the LMU
Language(s)	English
Additional information	None

Module: WP 12 Betreuung von Studierenden/Tutoring of students

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 12.1 Übung Betreuung von Studierenden/Practical course Tutoring of students	SoSe	45 h (3 SWS)	45 h	(3)

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 Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics

Elective guidelines With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.

Entry requirements None

Semester Recommended semester: 2

Duration The completion of the module takes 1 semester.

Content Tutoring of students: the students are tutoring other students in different courses. The courses could be on Bachelor or Master level. Requirement is sufficient knowledge in the specific field.

Learning outcomes Besides the content of the specific course students gain knowledge about course preparation including administration, preparation of material for experiments, answering strategies of questions and how to handle requirements of different students. They learn about self-organization, necessary preparation for the different contents and the necessary knowledge between understanding and teaching content to other students.

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

Dean of studies, all teaching staff of the different courses students are involved as tutors

Language(s)

English

Additional information

None

Module: WP 13 Berufsqualifikation I/Vocational course I

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 13.1 Übung Berufsqualifikation 1/Practical course Vocational course 1	SoSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 5 – WP 13, two compulsory elective modules must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	This module contains courses which equip students for their future career with necessary skills besides their biological knowledge. This could be courses e.g. about time management, self-organization, leadership, language and communication skills, entrepreneurship as well as internships in companies about marketing, human resources, management or administration.
Learning outcomes	At the end of the module each student will have a realistic perspective of the future work expectations regarding the soft skills. The objectives are to help students gain good self-positioning, self-reflection and self-organization, an understanding how to be a good communicator and listener with problem-solving skills in a modern work environment.
Type of examination	Presentation and report
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	Spokespersons, Dean of studies, teaching staff of the different courses
Language(s)	English
Additional information	None

Module: P 7 Schlüsselqualifikationen II/Soft Skills II

Programme	Master's Programme: Human Biology - Principles of Health and Disease Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	P 7.1 Schlüsselqualifikationen 2/Soft Skills 2	WiSe	30 h (2 SWS)	60 h	(3)
Seminar	P 7.2 Schlüsselqualifikationen 3/Soft Skills 3	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module contains courses which equip students for their future career with necessary skills besides their biological knowledge. This could be courses e.g. about time management, self-organization, leadership, language and communication skills, entrepreneurship as well as internships in companies about marketing, human resources, management or administration.
Learning outcomes	At the end of the module each student will have a realistic perspective of the future work expectations regarding the soft skills. The objectives are to help students gain good self-positioning, self-reflection and self-organization, an understanding how to be a good communicator and listener with problem-solving skills in a modern work environment.
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	Spokespersons, Dean of studies, teaching staff of the different courses
Language(s)	English
Additional information	None

Module: WP 14 Neurowissenschaften I/Neurosciences I

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 14.1 Vorlesung Neurowissenschaften/Lecture Neurosciences	WiSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 14.2 Übung Neurowissenschaften/Practical course Neurosciences	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	WP 14.3 Seminar Neurowissenschaften/Seminar Neurosciences	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 7 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics; Neurosciences
Elective guidelines	With regard to the compulsory elective modules WP 14 – WP 16, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	<p>Lecture: Building on more general biological courses on the Bachelor's level, the module aims to significantly deepen and expand knowledge and understanding in the Neurosciences. The following topics are addressed: Neurons and glia; Electrophysiological properties of neurons; Neuronal signaling mechanisms; Synaptic transmission; Neurotransmitter systems; Methods in Neuroscience; Introduction to Nervous System Development; Introduction to Comparative Neuroanatomy; Nervous System Plasticity, Cellular Mechanisms of Learning & Memory.</p> <p>Exercise: Students in this course will be introduced to fundamental experimental methods in Neuroscience, e.g. neuroanatomy and electrophysiology. In several hands-on experimental sessions they will learn the basic working</p>

principles of major anatomical staining techniques and electrophysiological setups, as well as record, discuss and interpret their respective datasets.

Seminar: In the seminar students will be asked to deepen their knowledge of the experimental techniques by presenting and discussing high-impact publications on neuroscientific topics.

Learning outcomes

Lecture: Students obtain fundamental knowledge in neuroscience required to participate in further courses in more specialized basic and clinical neuroscientific topics. Students are equipped with the basic knowledge prerequisite to participate in practical experiments. The students will be able to integrate knowledge and deal with the complexity of Neuroscience. The lecture will also provide students with the foundational knowledge required to understand and interpret novel findings and to extract new information from current publications in the field of Cellular and Systems Neuroscience.

Exercise: After successful completion of this module, students will have covered the most fundamental neuroscientific data acquisition techniques, as well as the basics of thoughtful and critical interrogation and interpretation of the recorded data.

Seminar: Students will have gained first insights into the most relevant neuroscientific topics and recent publications covering them. In presentations and especially the following discussions, they will develop a sense for critical thinking in the communication, reception and perception of published scientific data.

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. Dr. Benedikt, Prof. Dr. Hans Straka, Prof. Dr. Marin Kerschensteiner

Language(s)

English

Additional information

Recommended readings:

- Liqun Luo. Principles of Neurobiology, Garland Science
- Purves et al. (2018); Neuroscience, 6th Ed

- Mark F. Bear, Barry W. Connors, and Michael A. Paradiso. Neuroscience: Exploring the Brain. Philadelphia, PA: Lippincott Williams & Wilkins

Module: WP 15 Molekulare Onkologie I/Molecular Oncology I

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 14.1 Vorlesung Molekulare Onkologie/Lecture Molecular Oncology	WiSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 14.2 Übung Molekulare Onkologie/Practical course Molecular Oncology	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	WP 14.3 Seminar Molekulare Onkologie/Seminar Molecular Oncology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 7 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 14 – WP 16, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The lecture builds on the Bachelor's level, the module aims to significantly deepen and expand knowledge and understanding in the areas of Molecular Oncology. The following hallmarks of cancer are addressed: sustaining proliferative signaling, evading growth suppressors, resisting cell death, enabling replicative

immortality, inducing angiogenesis, and activating invasion and metastasis.

In the seminar, the students prepare a presentation and discuss critically problems related to the topics of the lecture: sustaining proliferative signaling, evading growth suppressors, resisting cell death, enabling replicative immortality, inducing angiogenesis, and activating invasion and metastasis. The students develop and apply own ideas. Specifically, the students select a topic, search and read relevant publications, develop based on the current state of knowledge aims and experimental strategy for an own research project that they present and discuss in the seminar.

In the practical course, the students will learn immunological, cell biological, and biochemical methods, as well as cutting-edge technologies. In the end of the practical course, the students will write a scientific report/protocol.

Learning outcomes	<p>Lecture: The students will be able to integrate knowledge and deal with the complexity of Molecular Oncology and to apply these capabilities to new approaches in Immunotherapy. They learn to make scientifically sound decisions in the areas of Molecular Oncology considering scientific and ethical evidence.</p> <p>Seminar: The students will be able to communicate their conclusions in a clear and unambiguous manner and to exchange information and ideas on a scientific level with experts in Molecular Oncology and with laypersons.</p> <p>Practical course: The students will be able to perform immunological, cell biological, and biochemical methods, as well as cutting-edge technologies.</p>
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. Dr. Marion Subklewe
Language(s)	English
Additional information	As additional learning material we recommend:

Cell and Molecular Biology. G. Karp. Wiley Verlag, 4. Auflage, ISBN: 0-471-65665-8

The Biology of Cancer. R. A. Weinberg. Garland Science, 1. Auflage, ISBN: 0-8153-4076-1

Module: WP 16 Herz-, Kreislauf- und Lungenforschung I/ Cardiovascular and Lung research I

Programme Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 16.1 Vorlesung Herz-, Kreislauf- und Lungenforschung/Lecture Heart, Circulation and Lung research	WiSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 16.2 Übung Herz-, Kreislauf- und Lungenforschung/Practical course Heart, Circulation and Lung research	WiSe	45 h (3 SWS)	45 h	(3)
Seminar	WP 16.3 Seminar Herz-, Kreislauf- und Lungenforschung/Seminar Heart, Circulation and Lung research	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 7 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 14 – WP 16, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Lectures: The lecture "Heart, Lung and Metabolism: From basic Physiology to Pathophysiological Processes and advanced Therapies" is a team-taught series lecture given by several instructors. The lecture will cover basic principles of the physiology but also pathomechanisms of the cardiovascular, respiratory and metabolic systems and will give an overview of current but also novel therapeutic

strategies. The lecture is given weekly (2 SWS) and requires regular attendance and a final exam.

Practical course:

Working in small lab-groups, students get hands-on experience in translational experimental methodologies commonly used to study heart, lung and metabolic disorders, including different in vivo, ex vivo, and in vitro model systems.

Seminar:

Using recommended actual peer-reviewed publications in the field of cardiovascular, respiratory and metabolic research, and with consultation of an instructor students will independently study the research paper and will prepare an approx. 30 minute oral presentation for the entire group.

Learning outcomes	Students will understand normal heart, lung and metabolic functions and will learn how and why these systems are changed upon corresponding chronic diseases; in addition, students will get familiar with commonly used therapies but will also realize the need for novel therapeutic options. In the practical course and the associated seminar students will receive an overview of a set of methods commonly used to study chronic heart, lung and metabolic disorders and will understand their advantages but also their practical limitations. Besides, working in small lab groups, social skills (teamwork, cooperation, fair play, mutual respect), communication skills (work delegation, written lab reports), as well as organizational skills (efficient planning, documentation) will be refined. Moreover, students are exposed to current literature and gain insight into language as well as presentation formats.
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. Thomas Gudermann
Language(s)	English
Additional information	None

Module: WP 17 Neurowissenschaften II/Neurosciences II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 17.1 Forschungspraktikum Neurowissenschaften/Research course Neurosciences	WiSe	180 h (12 SWS)	120 h	(10)
Seminar	WP 17.2 Begleitendes Seminar Neurowissenschaften/Accompanying seminar Neurosciences	WiSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 13 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics; Neurosciences
Elective guidelines	With regard to the compulsory elective modules WP 17 – WP 19, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	<p>Practical Course: In the hands-on practical laboratory course students will further hone their experimental skills while working on individual, scientifically relevant projects in the lab. Methods may include a wide array of neuroanatomical, molecular, electrophysiological and optogenetic techniques as well as approaches to study nervous system disease, depending on the specific type and current scientific interest of a lab that students choose to join.</p> <p>Seminar: Students will be expected to participate in a weekly held labmeeting to present and discuss recent scientific publications that are relevant for the current research topic in the lab, as well as give a short progress report on their own work. At the end of the practical course they will be asked to present the main findings of their respective project.</p>

Learning outcomes

Practical Course: By completing this practical course students will gain actual experimental experience and get first insights into everyday laboratory practice in the field of basic and clinical neuroscience. In the ideal case this course could serve as a first step in developing ideas and acquiring data for a Master's thesis or even a scientific publication to boost a possible academic career in neuroscience.

Seminar: By successfully finishing this part of the module students will have learned to research published scientific information that might be critically important to their own scientific work, as well as further improve their ability to think critically about scientific publications. Moreover, they will gain experience in effective communication and presentation of their own data and that of others.

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	All Professors of the main topic "Neurosciences"
Language(s)	English
Additional information	<p>Recommended Readings: depends on the lab students choose to join, for in-vitro electrophysiology (especially patch-clamping) two examples are listed below:</p> <ul style="list-style-type: none"> • Areles Molleman, Patch Clamping: An Introductory Guide to Patch Clamp Electrophysiology • - Bertil Hille, Ionic Channels of Excitable Membranes

Module: WP 18 Molekulare Onkologie II/Molecular Oncology II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 18.1 Forschungspraktikum Molekulare Onkologie/Research course Molecular Oncology	WiSe	180 h (12 SWS)	120 h	(10)
Seminar	WP 18.2 Begleitendes Seminar Molekulare Onkologie/Accompanying seminar Molecular Oncology	WiSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 13 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 17 – WP 19, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	<p>In the practical course, the students plan and perform scientific experiments. In the end of the practical course, the students will write a scientific report/protocol.</p> <p>In the seminar, the students critically discuss problems related to the topics of their own research practical course. The students develop and apply own ideas, search and read relevant publications, develop based on the current state of knowledge aims and experimental strategy for an own research project that they present and discuss in the seminar.</p>
Learning outcomes	Seminar: The students will be able to communicate their conclusions in a clear and unambiguous manner and to exchange information and ideas on a scientific level with experts in Molecular Oncology and with laypersons.

Practical course: The students will be able to interpret and conclude their findings in an unambiguous manner and to exchange information and ideas on a scientific level with experts in Molecular Oncology and with laypersons.

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	All Professors from the main topic "Molecular Oncology".
Language(s)	English
Additional information	<p>As additional learning material we recommend:</p> <p>Cell and Molecular Biology. G. Karp. Wiley Verlag, 4. Auflage, ISBN: 0-471-65665-8</p> <p>The Biology of Cancer. R. A. Weinberg. Garland Science, 1. Auflage, ISBN: 0-8153-4076-1</p>

Module: WP 19 Herz-, Kreislauf- und Lungenforschung II/Cardiovascular and Lung research II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 19.1 Forschungspraktikum Herz-, Kreislauf- und Lungenforschung/Research course Heart, Circulation and Lung research	WiSe	180 h (12 SWS)	120 h	(10)
Seminar	WP 19.2 Begleitendes Seminar Herz-, Kreislauf- und Lungenforschung/Accompanying seminar Heart, Circulation and Lung research	WiSe	15 h (1 SWS)	45 h	(2)

For successful completion of the module, 12 ECTS credits have to be acquired. Class attendance averages about 13 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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 17 – WP 19, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	<p>Practical research courses are independent projects arranged by teaching staff members of different groups according to current research topics. Research labs last for the equivalent of 8 full-time working weeks in the lab and subsequent preparation of a written lab report. The course is intended as specialized internship, requiring advanced skills and excellent lab conduct.</p> <p>Seminar: Students will be expected to participate in a weekly held labmeeting to present and discuss recent scientific publications that are relevant for the current</p>

research topic in the lab, as well as give a short progress report of their respective project.

Learning outcomes	Students are required to work independently under close supervision of an instructor and will learn specialized techniques used in the analysed research field. In addition, participants will gain experience in generating a working hypothesis and in designing a particular experiment. They will also be trained in critically evaluating their own results and in writing a final report according to international scientific standards. Attending the seminar and giving a short progress report on their own work students will also improve their ability to communicate with other scientists. These skills are particularly aimed at preparing students for theses writing and scientific publications.
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	All Professors from the main topic „
Language(s)	English
Additional information	None

Module: WP 20 Spezielle Themen in der Biomedizin/Special topics in Biomedical Sciences

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 20.1 Vorlesung Spezielle Themen in der Biomedizin/Lecture Special topics in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 20 – WP 24, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Report
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	Please refer to the elective course catalogue for the master programme.

Language(s) English

Additional information None

Module: WP 21 Spezielle Methoden in der Biomedizin/Special methods in Biomedical Sciences

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 21.1 Übung Spezielle Methoden in der Biomedizin/Practical Special methods in Biomedical Sciences	WiSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 20 – WP 24, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
Type of examination	Written exam
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	Please refer to the elective course catalogue for the master programme.
Language(s)	English
Additional information	None

Module: WP 22 Aktuelle Publikationen zu speziellen Forschungsthemen in der Biomedizin/Current publications on special research topics in Biomedical Sciences

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 22.1 Seminar Aktuelle Publikationen zu speziellen Forschungsthemen in der Biomedizin/Seminar Current publications on special research topics in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 20 – WP 24, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	For the content of each module please refer to the course catalogue.
Learning outcomes	For the learning outcomes of each module please refer to the course catalogue.
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

Please refer to the elective course catalogue for the master programme.

Language(s)

English

Additional information

None

Module: WP 23 Ethik in der Biomedizin/Ethics in Biomedical Sciences

Programme	Master's Programme: Human Biology - Principles of Health and Disease (Master of Science, M.Sc.)
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Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 23.1 Seminar Ethik in der Biomedizin/Seminar Ethics in Biomedical Sciences	WiSe	30 h (2 SWS)	60 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 20 – WP 24, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module provides an introduction to ethics in health sciences. Students will learn about the history and principles of ethics of scientific research, medicine and healthcare research. Regarding the supervisor special emphasis will be given to social and global justice in healthcare or to the ethics of human enhancement.
Learning outcomes	At the end of the module students will have an understanding of the basics of ethics and ethical thinking. The student can identify and discuss critically ethical issues in everyday life, medicine, health care and life science.
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	Spokespersons, Dean of Studies, Munich Center of Ethics of the LMU
Language(s)	English
Additional information	None

Module: WP 24 Berufsqualifikation II/Vocational course II

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical course	WP 24.1 Übung Berufsqualifikation 2/Practical course Vocational course II	WiSe	45 h (3 SWS)	45 h	(3)

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	Master's Programmes: Molecular and Cellular Biology; Plant Sciences; Evolution, Ecology and Systematics
Elective guidelines	With regard to the compulsory elective modules WP 20 – WP 24, one compulsory elective module must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module contains courses which equip students for their future career with necessary skills besides their biological knowledge. This could be courses e.g. about time management, self-organization, leadership, language and communication skills, entrepreneurship as well as internships in companies about marketing, human resources, management or administration.
Learning outcomes	At the end of the module each student will have a realistic perspective of the future work expectations regarding the soft skills. The objectives are to help students gain good self-positioning, self-reflection and self-organization, an understanding how to be a good communicator and listener with problem-solving skills in a modern work environment.
Type of examination	Presentation or report
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	Spokespersons, Dean of studies, teaching staff of the different courses
Language(s)	English
Additional information	None

Module: P 8 Vernetzung in der biomedizinischen Forschung/Interconnectedness in Biomedical Sciences

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	P 8.1 Biomedizinisches Kolloquium/Biomedical colloquium	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)
Seminar	P 8.2 Biomedizinisches Forschungsseminar/Biomedical research seminar	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)

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	None
Entry requirements	None
Semester	Recommended semester: 4
Duration	The completion of the module takes 1 semester.
Content	The students attend 20 scientific talks, including scientific talks of invited guest speakers from outside the LMU, and the research seminar of their work group.
Learning outcomes	Students meet researchers outside of both faculties and are aware of additional current research topics. Within the research seminar the participants gain holistic knowledge on the topic of their master's thesis. They are able to present their current work in the research seminar and discuss current research questions related to their thesis. They understand the conception of experiments, trouble shooting procedures and critical analysis and presentation of data.
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

Qualified supervisor from the Medical Faculty and the Faculty of Biology.

Language(s)

English

Additional information

None

Module: P 9 Abschlussmodul/Final module

Programme

Master's Programme:
Human Biology - Principles of Health and Disease
(Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Thesis	P 9.1 Masterarbeit/Master's thesis	WiSe and SoSe	-	780 h	(26)
Disputation	P 9.2 Disputation	WiSe and SoSe	-	30 h	(1)

For successful completion of the module, 27 ECTS credits have to be acquired. 810 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	Successful completion of the modules P 1 – P 5 and completed acquisition of 27 ECTS credits from the compulsory elective modules WP 1 – WP 13
Semester	Recommended semester: 4
Duration	The completion of the module takes 1 semester.
Content	The master's final module is composed of a master's thesis and oral defense. This module represents the climax of the master's programme and requires independent experimental work under supervision of an instructor/advisor.
Learning outcomes	The module requires skills in organization, strategic methodological planning and performance of experiments, documentation and interpretation of results, in addition to completion of a final thesis written according to international scientific standards. The oral defense tests communication skills, basic and applied knowledge in the given subject, and ability to explain specific processes in a broader context.
Type of examination	Thesis and disputation

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	Qualified supervisor from the Medical Faculty and the Faculty of Biology.
Language(s)	English
Additional information	None