Subdivided Module Catalogue
for the Subject
Biomedicine
as a Master's with 1 major
with the degree "Master of Science"
(120 ECTS credits)

Examination regulations version: 2015
Responsible: Faculty of Medicine
Responsible: Faculty of Biology
Course of Studies - Contents and Objectives

The Faculty of Medicine and the Faculty of Biology of the JMU Würzburg offer the opportunity to acquire a “Master of Science” (M.Sc.) degree in Biomedicine within a consecutive Bachelor’s and Master’s programme. This degree programme has a strong emphasis on research. This Master of Science degree equips graduates with further professional qualifications as well as extensive research experience. This degree programme aims to impart to students in-depth and interdisciplinary knowledge at the interface between biology and medicine and to enable them to competently apply and implement concepts and methods of molecular medicine. Students in this degree programme gain the skills and specialist knowledge necessary for a career in research, development and practical application and will be able to independently conduct scientific research in the field of biomedicine.

In their thesis, students demonstrate their ability to illustrate and handle a defined biomedical problem from an academic perspective using established or modified methods within a given time frame.
Abbreviations used

Course types: E = field trip, K = colloquium, O = conversatorium, P = placement/lab course, R = project, S = seminar, T = tutorial, Ü = exercise, V = lecture

Term: SS = summer semester, WS = winter semester

Methods of grading: NUM = numerical grade, B/NB = (not) successfully completed

Regulations: (L)ASPO = general academic and examination regulations (for teaching-degree programmes), FSB = subject-specific provisions, SFB = list of modules

Other: A = thesis, LV = course(s), PL = assessment(s), TN = participants, VL = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2015

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

13-Jul-2015 (2015-13) except for mandatory electives 03-98-FBM-172, 08-MBC-EMV-172 added in Fast Track procedure at a later time

24-Nov-2016 (2016-109) except for mandatory electives 03-98-FBM-172, 08-MBC-EMV-172 added in Fast Track procedure at a later time

06-Dec-2017 (2017-71)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.
The subject is divided into

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<th>holder of the Chair of Bioinformatics</th>
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<td>1 semester</td>
<td>graduate</td>
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**Contents**

Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e. g. net generation sequences, proteomics data), analysis of different functional RNAs (e. g. miRNAs, IncRNAs).

**Intended learning outcomes**

Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: German and/or English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<td>Please consult with degree programme coordinator in advance.</td>
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**Contents**

Presentation and critical discussion of current thesis projects.

**Intended learning outcomes**

Students understand current research projects in the life sciences and are able to discuss and evaluate these.

**Courses** (type, number of weekly contact hours, language — if other than German)

- V (3)
  - Module taught in: German/English
  - Course type: alternatively P or S

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

- a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

**Language of assessment:** German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Subdivided Module Catalogue for the Subject Biomedicine
Master's with 1 major, 120 ECTS credits

<table>
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<th>Module title</th>
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<td>Electron microscopy and image processing in structural biology</td>
<td>08-MBC-EMV-172-m01</td>
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<td>Chair of Biochemistry</td>
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Contents

The module "Electron Microscopy and Image Processing in Structural Biology" contains a lecture part which explains the basics of electron microscopy and image processing. First, the components of the electron microscope, beam path, image formation and contrast transmission are explained. Subsequently, different methods of sample preparation for electron microscopy in structural biology will be discussed as well as strategies for instrument alignment and data acquisition. The second part of the lecture concentrates on the processing of image data. The focus is on the principles of single image analysis. This includes the alignment of image data, their classification and three-dimensional image reconstruction. DeNovo and iterative methods of 3D image reconstruction are discussed. The learned principles are then applied to the special cases of 2D crystal analysis and tomography. Finally, micro electron diffraction is presented as an alternative to X-ray structure analysis. In the seminar part of the module some aspects of the lecture are deepened on the basis of case studies from the literature. The students will read these case studies in advance. In this work they are guided through a catalogue of questions. Some of the questions will be addressed independently in a written homework in advance. Most case studies will be presented by one student each. All case studies will be explained in a discussion. The participants develop a critical understanding of the advantages and limitations of the method. Some selected topics will be further deepened by arithmetic exercises.

Intended learning outcomes

The participants will learn the theoretical basics of electron microscopy and image processing in structural biology on a broad basis. They will get an overview of key strategies of the method, which are essential for structure elucidation. These can be applied and deepened in a practical course. In the end, all participants will be able to understand, communicate and critically evaluate primary literature on this method.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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### Module title
Fluorescence methods in biomedicine

### Abbreviation
03-98-FBM-172-m01

### Module coordinator
holder of the Professorship of Molecular Microscopy

### Module offered by
Faculty of Medicine

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
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### Duration
1 semester

### Module level
graduate

### Other prerequisites
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### Contents
No information on contents available.

### Intended learning outcomes
No information on intended learning outcomes available.

### Courses
(type, number of weekly contact hours, language — if other than German)

V (2) + S (1)

**Module taught in:** German / English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) oral examination of one candidate each (20 to 30 minutes) or b) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 30 minutes). Students will be informed about the method, length and scope of the assessment prior to the course.

**Language of assessment:** German and/or English
Module title: Advanced Laboratory Course in Biology
Abbreviation: 03-98-MFPB-152-m01

Module coordinator: Dean of Studies Biomedizin (Biomedicine)
Module offered by: Faculty of Medicine

ECTS: 10
Method of grading: Only after succ. compl. of module(s)
Duration: Module level: graduate
Other prerequisites: Prior approval from Dean of Studies required.

Contents
Participation in a research project in the life sciences. Students will become familiar with new methods and approaches. Contents and methods will vary according to the research laboratory chosen.

Intended learning outcomes
Application of current methods to diverse and complex scientific questions. Critical data collection and analysis as well as interpretation of new findings. Presentation of data.

Courses (type, number of weekly contact hours, language — if other than German)
P (10)
Module taught in: German/English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
practical assignment with examination talk (approx. 20 to 30 minutes) and log (approx. 15 to 20 pages)
Language of assessment: German or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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**Contents**

Participation in a research project in the life sciences. Students will become familiar with new methods and approaches. Contents and methods will vary according to the research laboratory chosen.

**Intended learning outcomes**

Application of current methods to diverse and complex scientific questions. Critical data collection and analysis as well as interpretation of new findings. Presentation of data.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (10)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

practical assignment with examination talk (approx. 20 to 30 minutes) and log (approx. 15 to 20 pages)

Language of assessment: German or English

**Allocation of places**

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**Additional information**

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<td>1 semester</td>
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**Contents**

Presentation of current research topics in the lecture series "Immunology" with ensuing discussion.

**Intended learning outcomes**

Students are introduced to the current research areas in immunology.

**Courses**

(type, number of weekly contact hours, language — if other than German)

S (3)

Module taught in: German/English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
--- | ---
Genome stability | 08-MBC-GST-152-m01

Module coordinator | Module offered by
--- | ---
holder of the Chair of Biochemistry | Chair of Biochemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | graduate | --

Contents
The module imparts detailed and in-depth the current state of science in the field of research on the stability of genomes in dependence of certain structural and epigenetic factors.

Intended learning outcomes
After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + S (1)
Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.
Language of assessment: German and/or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<table>
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**Contents**

Familiarity with the fundamentals of molecular and cellular immunology that allow a deeper understanding of immune-mediated defence mechanisms. This incorporates common literature readings, presentations and tests on selected immunology book chapters and recent original literature in English language.

**Intended learning outcomes**

Students will gain a knowledge of fundamental concepts and methods in molecular and cellular immunology and will be able to present and discuss these.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) presentation (20 to 45 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Winter semester only

Language of assessment: German or English

**Allocation of places**

--

**Additional information**

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**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

--
### Module title
Immunology 2 BM

### Abbreviation
03-98-ImmM2-152-m01

### Module coordinator
holder of the Professorship of Immunogenetics

### Module offered by
Faculty of Medicine

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
Recent progress in molecular and cellular immunology. Deeper insights into selected immunology chapters, such as autoimmunity and immune modulation, development of the immune system, immunogenetics, evolution, infection immunology, and more. This incorporates common literature readings, presentations and tests on selected immunology book chapters and recent original literature.

### Intended learning outcomes
Students are able to understand current problems in immunology and to discuss these in detail.

### Courses
(type, number of weekly contact hours, language — if other than German)
S (2)

Module taught in: German/English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) presentation (20 to 45 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Summer semester only
Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
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**Contents**

Fundamentals of molecular microbiology and infection biology, mechanisms of adherence and invasion, bacterial pathogenicity factors, regulation of virulence, mechanisms of host defence and pathogen interference, current methods in infection biology.

**Intended learning outcomes**

The students are able to understand fundamental theories of molecular microbiology and infection biology, emergence of infectious diseases.

**Courses (type, number of weekly contact hours, language — if other than German)**

V (2)
Module taught in: German and/or English

**Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)**

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
### Module title
Cardiovascular Biology

### Abbreviation
03-98-MVKB-152-m01

### Module coordinator
holder of the Chair of Experimental Biomedicine

### Module offered by
Faculty of Medicine

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
Becoming familiar with the basics of the cardiovascular system by means of a lecture series. The first section comprises the anatomical, physiological and bio-chemical basis. In the second section these fundamentals will be deepened based on relevant cardiovascular diseases of platelets, the vasculature and the heart. In the context of these disorders, current and future targets for adequate therapies will be discussed.

### Intended learning outcomes
Students have developed the ability to understand the molecular and physiological basics relevant for cardiovascular biology, with the focus on developmental biology, platelets and coagulation. These will be exemplified by stroke, myocardial disorders, metabolic syndrome, vasculitides and genetic causes. After attending the lecture series, students will be able to understand, describe and assign pathological and pathophysiological changes affecting the cardiovascular system.

### Courses
(V (2)
Module taught in: German/English

### Method of assessment
(a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Once a year, winter semester

Language of assessment: German or English

### Allocation of places
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### Additional information
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**Contents**

Attending a lecture on the foundations of clinical medicine for medical students. Contents will vary according to the subject chosen.

**Intended learning outcomes**

Students will gain an insight into clinical practice and will improve their ability to link basic and experimental knowledge with corresponding clinical applications.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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</table>

**Contents**

Attending a lecture on the foundations of clinical medicine for medical students. Contents will vary according to the subject chosen.

**Intended learning outcomes**

Students will gain an insight into clinical practice and will improve their ability to link basic and experimental knowledge with corresponding clinical applications.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (3)  
Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).  
Students will be informed about the method, length and scope of the assessment prior to the course.  
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Module title
Clinical Neurobiology

### Abbreviation
03-98-MVKN-152-m01

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### Contents
Students will get a theoretical introduction to neurobiology and clinical neurobiology. The following topics will be discussed: introduction to neurons and glia, ion channels and membrane potential, ion channelopathies, synapses, transmitter release, NMJ, myasthenia gravis, cerebellum, basal ganglia, ataxia and Morbus Parkinson, somatosensory system, touch, pain, schizophrenia and autism spectrum disorders, disorders of cognition, muscle and muscle diseases, anatomy and function of the motor system, spinal reflexes, motoneuron diseases, hippocampus, learning and memory, anterograde amnesia, visual agnosia, cortex and the limbic system, emotions, disorders of conscious and unconscious mental processes, attention, smell and taste and hearing, sleep, EEG, epilepsy, vision and diseases of the visual system. The literature seminars are based on fundamental literature on lecture-relevant topics to document the experiments underlying our present knowledge in neurobiology.

### Intended learning outcomes
Students who successfully completed this module will have acquired insights into current theoretical concepts in neurobiology. They will have examined clinical aspects of neurobiology with a focus on the molecular, cellular and physiological mechanisms. Additionally, they will have learned how to evaluate and present data in oral form. The students will have learned to critically read scientific publications in the field of neurobiology and will have been trained in the ability to extract relevant information from the original literature.

### Courses
(type, number of weekly contact hours, language — if other than German)

V (2) + S (2)
Module taught in: English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or d) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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### Contents

In the module "Klinische Onkologie" ("Clinical Oncology"), various clinicians will present a current view of the disease "cancer". Topics will include an overview of different tumour entities (including cancers of the blood, skin, breast, lung, liver, colon, endocrine system), treatment modalities (e.g. immunotherapy, radiation-based therapy, personalised medicine), diagnostics, pathology, clinical studies.

### Intended learning outcomes

An understanding of the biological commonalities and particularities of different tumour types. An understanding of the needs, possibilities and limitations of clinical approaches.

### Courses (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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**Contents**

Students present the results of their thesis projects in a scientific colloquium.

**Intended learning outcomes**

Students are able to present and defend the data from their thesis project in front of a professional audience.

**Courses** *(type, number of weekly contact hours, language — if other than German)*

K (0)

Module taught in: German / English

**Method of assessment** *(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)*

final colloquium (approx. 30 to 45 minutes)

Language of assessment: English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

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### Subdivided Module Catalogue for the Subject Biomedicine

#### Master’s with 1 major, 120 ECTS credits

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</table>

### Contents

The module imparts detailed and in-depth the current state of science in the field of research on the regulation and control of the entire life cycle of proteins.

### Intended learning outcomes

After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

### Courses (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)

Module taught in: German or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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**Contents**

Students conduct a scientific research project using appropriate methods and adhering to the principles of good scientific practice. They document and discuss their work in a thesis.

**Intended learning outcomes**

Students are able to independently carry out scientific work according to the rules of good scientific practice. They are able to document and, where necessary, adjust their research as well as to interpret their findings in a larger context.

**Courses** *(type, number of weekly contact hours, language — if other than German)*

No courses assigned to module

Module taught in: German / English

**Method of assessment** *(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)*

Master's thesis (approx. 30 to 60 pages)

Language of assessment: English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

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### Module title

Model Organisms

### Abbreviation

03-98-MMOD-152-m01

### Module coordinator

Dean of Studies Biomedizin (Biomedicine)

### Module offered by

Faculty of Medicine

### ECTS

20

### Method of grading

numerical grade

### Only after succ. compl. of module(s)

--

### Duration

graduate

### Other prerequisites

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### Contents

With the help of selected eukaryotic model organisms (mouse, fish, Drosophila, nematodes and flatworms, yeast) and complex tissue models, students will become familiar with methods and questions of experimental biomedicine and will apply these. Building on the students' knowledge of anatomy, cell biology and developmental biology, the module will illustrate the relevance and usage of individual models for understanding physiological processes and pathophysiological changes and will experimentally analyse these with molecular, cell biological, histological and imaging techniques. The module will acquaint students with cell-based strategies for regenerative therapies and biodiagnostics as well as as an alternative to animal experiments. Over the course of one week each, students will examine model organisms in detail, also taking into account current research.

### Intended learning outcomes

Students are able to define key terms for each model organism and use them in the right context. They are able to correctly assess the importance of model organisms and 3D tissue culture systems for current biomedical issues and questions. They are able to discuss the relevant scientific advantages and disadvantages in a deliberative manner, also taking into account ethical issues. Under supervision, they are able to independently perform sophisticated genetic, cell biological and histological experiments and document the results. In particular, they are able to present the results in a written report in accordance with scientific standards, to critically evaluate and interpret the data and put it in the context of current literature. Working in small groups as well as preparing and delivering group presentations, they demonstrate their knowledge of the contents covered as well as their team working skills.

### Courses

(type, number of weekly contact hours, language — if other than German)

S (3) + P (15)

Module taught in: German/English

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Log (30 to 60 pages)

Assessment offered: Once a year, winter semester

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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### Module title
Molecular Oncology

### Abbreviation
03-98-MVMO-152-m01

### Module coordinator
holder of the Chair of Biochemistry and Molecular Biology

### Module offered by

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
graduate

### Other prerequisites
--

### Contents
Molecular mechanisms of tumourigenesis; experimental dissection of tumours; metabolic reprogramming in cancer; visualising in vivo tumour progression and response to therapy; targeting Myc for tumour therapy; Wnt signalling and colorectal cancer; cell cycle and tumour suppressor genes; protein turnover in normal and cancer cells; molecular mechanisms of melanoma development; tumour immunology; stem cells and epigenetics; signal transduction and personalised cancer therapy; molecular pathology; infections and tumour development.

### Intended learning outcomes
Students understand the current topics and challenges in tumour research and the methods used to address such challenges.

### Courses
(type, number of weekly contact hours, language — if other than German)
V (2)
Module taught in: German/English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Once a year, winter semester
Language of assessment: German or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
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<td>Pathogenicity of Microorganisms BM</td>
<td>07-MM2-B-152-m01</td>
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Contents

Fundamental principles of the mode of action of microbial pathogenicity factors will be presented using selected prokaryotic and eukaryotic pathogens as model organisms. In addition, current research methods in infection biology will be presented.

Intended learning outcomes

Students have gained fundamental knowledge in infection biology and pathogenicity research and the mechanisms behind infectious diseases.

Courses (type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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**Contents**

Students will work on a current topic in the field of human genetics.

**Intended learning outcomes**

Participants have acquired the knowledge and skills necessary to carry out scientific work in different areas of human genetics. They are able to work on problems in human genetics, adhering to the principles of good scientific practice, as well as to document their work.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (10)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

Project work in a research laboratory, focusing on training in new methods and the in-depth analysis of a complex scientific problem. This project may lay the foundation for a subsequent Master's thesis.

**Intended learning outcomes**

Execution of complex sequential experimental methods. Students gain an insight into new areas of research on the basis of current literature and knowledge transfer.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (15)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Log (approx. 20 to 30 pages) or research proposal for thesis based on project (approx. 10 to 20 pages)

Language of assessment: English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

The module imparts detailed and in-depth the current state of science in the field of research on RNA-protein complexes, their structure and function, as well as the theoretical basics of current RNA-based research methods.

**Intended learning outcomes**

After participating in the module events, the student is familiar with the course contents and is able to transfer them to new scientific problems. He/She is able to classify new research results in the context of recent findings and to assess their significance.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)

Module taught in: German or English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

This module will discuss current topics in human genetics.

**Intended learning outcomes**

Students have developed the ability to understand relevant questions in human genetics and to discuss these in detail.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title: Stem Cell Biology
Abbreviation: 03-98-MVSZ-152-m01

Module coordinator: Institute of Medical Radiology and Cell Research (MSZ)
Module offered by: Faculty of Medicine

ECTS: 5
Method of grading: numerical grade
Duration: 1 semester
Module level: graduate
Other prerequisites: --

Contents
In this module, selected current problems from the fields of stem cell biology, cellular differentiation and regenerative medicine are used to provide basic knowledge as well as analytical approaches. The current state of research is considered on the basis of the historical context. Selected examples are used to learn about topic-specific contexts. Special emphasis is placed on the methodology used to study and characterize stem cells at the molecular level in vivo and in vitro. Bio-ethical and legal frameworks are discussed in the course of the lecture.

Intended learning outcomes
Necessary basic knowledge to work on, analyze and critically interpret questions from stem cell biology, cellular differentiation and regenerative medicine on the basis of current literature. A basic methodological competence for independent scientific work in the field of stem cell biology. Development of an ethical awareness in relation to the application of stem cells in biomedicine.

Courses (type, number of weekly contact hours, language — if other than German)
V (2)
Module taught in: German/English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.
Assessment offered: Once a year, summer semester
Language of assessment: German or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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### Systems Biology B

**Abbreviation:** 07-MS-B-152-m01

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<td>holder of the Chair of Bioinformatics</td>
<td>Faculty of Biology</td>
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#### Contents

Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.

#### Intended learning outcomes

Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.

#### Courses

(type, number of weekly contact hours, language — if other than German)

V (2)

Module taught in: German and/or English

#### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Students will be informed about the method, length and scope of the assessment prior to the course. Usually, one of the following options will be chosen: a) written examination (30 to 60 minutes, including multiple choice questions) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (30 to 60 minutes)

Language of assessment: German and/or English

#### Allocation of places

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#### Additional information

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#### Referred to in LPO 1

(examination regulations for teaching-degree programmes)

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<td>holder of the Chair of Tissue Engineering (University Hospital)</td>
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### Contents

Cell culture techniques, fundamentals of tissue engineering, test systems as an alternative to animal experiments in skin, intestine, lung, trachea, kidney, blood-brain barrier, tumours and other diseases, development of cell-based transplants, regulatory fundamentals for approval of medical products and drugs. These are REACH (registration, evaluation, restriction and approval of drugs), medicine products law, GLP (good lab practice), GMP (good manufacturing practice), GCP (good clinical practice).

### Intended learning outcomes

The student has expertise in tissue engineering, regenerative medicine, bioprocess engineering, test systems and basic relationships in the field of cell biology, metabolism, differentiation, adhesion to surfaces and mechanobiology. The student has methodological competence in quality management. The contents taught in the course lead to a deeper understanding of these competence fields and enable the application, which allows an independent assessment by analyzing publications or questions. For this purpose, the student should be able to understand a scientific publication in this field, to acquire additional background knowledge independently and, after analyzing the experimental results, to evaluate and discuss them critically.

### Courses (type, number of weekly contact hours, language — if other than German)

- **V (2)**
  - Module taught in: German/English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

- a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes).

Students will be informed about the method, length and scope of the assessment prior to the course.

Assessment offered: Once a year, winter semester

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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<td>Tumor Genetics</td>
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**Module coordinator**

holder of the Professorship Human Genetics at Institute for Human Genetics

**Module offered by**

Institute of Human Genetics

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**Contents**

Basics on human genetics (inheritance patterns, mutation types, etc.), hereditary cancer (breast & ovarian cancer, HNPCC, FAP, etc.), cancer syndromes, tumor cytogenetics, epigenetics in cancer, animal models in cancer genetics, genetic techniques (NGS, genome engineering, etc.)

**Intended learning outcomes**

The students have acquired broad knowledge in the field of tumor genetics and hereditary tumor diseases as well as specific knowledge about genetic methods. They are able to apply this acquired knowledge to scientific questions in tumor genetics. Students can independently develop scientific texts, discuss them critically and present them.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (1)

Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (approx. 45 to 90 minutes) or b) log (20 to 30 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) or e) presentation (20 to 40 minutes)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title: Virology 1 BM
Abbreviation: 03-98-VirM1-152-m01
Module coordinator: holder of the Chair of Virology
Module offered by: Faculty of Medicine
ECTS: 5
Method of grading: numerical grade
Only after succ. compl. of module(s)
Duration: 1 semester
Module level: graduate
Other prerequisites:
Contents:
This module will discuss contemporary topics in virology.
Intended learning outcomes:
Students are able to understand current problems in virology and to discuss these in detail.
Courses (type, number of weekly contact hours, language — if other than German):
V (1) + S (2)
Module taught in: German/English
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus):
a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)
Students will be informed about the method, length and scope of the assessment prior to the course.
Assessment offered: Winter semester only
Language of assessment: German and/or English
Allocation of places:
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Additional information:
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Referred to in LPO 1 (examination regulations for teaching-degree programmes):
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**Contents**

This module will discuss contemporary topics in virology.

**Intended learning outcomes**

Students are able to understand current problems in virology and to discuss these in detail.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (1) + S (2)
Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)
Students will be informed about the method, length and scope of the assessment prior to the course.
Assessment offered: Summer semester only
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Knowledge Transfer / Tutoring</td>
<td>03-98-MTUT2-152-m01</td>
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<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tbody>
<tr>
<td>Dean of Studies Biomedizin (Biomedicine)</td>
<td>Faculty of Medicine</td>
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<th>ECTS</th>
<th>Method of grading</th>
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<tr>
<th>Duration</th>
<th>Module level</th>
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<tr>
<td>1 semester</td>
<td>graduate</td>
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</table>

**Contents**

Students work as tutors. They support other students, in particular in the context of courses and study planning, and they participate as assistants in the organisation and planning of exercises and lab courses.

**Intended learning outcomes**

Tutors are able to communicate complex technical facts in a clear and structured way. They have gained experience in the supervision and motivation of groups, and they have practised applying conflict resolution strategies.

**Courses** (type, number of weekly contact hours, language — if other than German)

T (2)

Module taught in: German/English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or
b) log (approx. 10 to 20 pages) or
c) oral examination of one candidate each (30 to 60 minutes) or
d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or
e) presentation (20 to 45 minutes) or
f) preparing and supervising study groups/student lab courses (type and length/ scope of assessment to be specified at the beginning of the course). Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Subdivided Module Catalogue for the Subject Biomedicine
Master's with 1 major, 120 ECTS credits

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<td>May only be taken as an alternative to MTUT2.</td>
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Contents

Students work as tutors. They support other students, in particular in the context of courses and study planning, and they participate as assistants in the organisation and planning of exercises and lab courses.

Intended learning outcomes

Tutors are able to communicate complex technical facts in a clear and structured way. They have gained experience in the supervision and motivation of groups, and they have practised applying conflict resolution strategies.

Courses (type, number of weekly contact hours, language — if other than German)

T (3)

Module taught in: German/English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) or e) presentation (20 to 45 minutes) or f) preparing and supervising study groups/student lab courses (type and length/scope of assessment to be specified at the beginning of the course). Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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### Module title
Cell and Developmental Biology Master BM

### Abbreviation
07-MZE-BM-152-m01

### Module coordinator
holder of the Chair of Cell Biology and Developmental Biology

### Module offered by
Faculty of Biology

### ECTS
5

### Method of grading
Only after succ. compl. of module(s)

### Duration
1 semester

### Module level
graduate

### Other prerequisites
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### Contents
The module consists of the lecture Zellpathologie (Cytopathology) and the seminar Zellbiologie-Milesteine und Perspektiven (Milestones and Perspectives of Cell Biology). The lecture describes pathological states of the cell and unravels their biological causes and consequences, such as infection, apoptosis, senescence, metabolic disorders and cancer. In the seminar Milestones and Perspectives of Cell Biology, classic ground-breaking publications in the field of cell biology are discussed from an unusual point of view.

### Intended learning outcomes
Participants possess scientific background knowledge on cytopathology and are able to put this into the broader context of cell biology research.

### Courses
(type, number of weekly contact hours, language — if other than German)

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Weekly Contact Hours</th>
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Module taught in: German/English

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) written examination (30 to 60 minutes) or b) oral examination of one candidate each (30 to 60 minutes) or c) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes)

Students will be informed about the method, length and scope of the assessment prior to the course.

Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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