Modulhandbuch

Master of Science Molekulare Medizin

Prüfungsordnungsversion 2015
Inhaltsverzeichnis

Block

<table>
<thead>
<tr>
<th>Module</th>
<th>Seite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Diseases and Immune Defense</td>
<td>1</td>
</tr>
<tr>
<td>Molecular Oncology</td>
<td>4</td>
</tr>
<tr>
<td>Signaling Pathways in Stem Cells, Development and Aging</td>
<td>7</td>
</tr>
<tr>
<td>Trauma Research and Regenerative Medicine</td>
<td>10</td>
</tr>
</tbody>
</table>

Compulsory Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Seite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioinformatics and Systems Biology</td>
<td>13</td>
</tr>
<tr>
<td>Clinical Trials and Project Management and Funding</td>
<td>15</td>
</tr>
<tr>
<td>Current Concepts in Stem Cell Biology and Regenerative Medicine</td>
<td>18</td>
</tr>
<tr>
<td>GLP/GSP and Bioethics</td>
<td>20</td>
</tr>
<tr>
<td>New Drug Discovery, Development and Evaluation</td>
<td>25</td>
</tr>
<tr>
<td>Practical Training in Laboratory Methods and Correlative Imaging</td>
<td>28</td>
</tr>
</tbody>
</table>

Master Thesis

<table>
<thead>
<tr>
<th>Module</th>
<th>Seite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master's Thesis and Disputation</td>
<td>31</td>
</tr>
</tbody>
</table>
Infectious Diseases and Immune Defense
Modul zugeordnet zu Block

<table>
<thead>
<tr>
<th>Code</th>
<th>8810772136</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS-Punkte</td>
<td>12</td>
</tr>
<tr>
<td>Präsenzzeit</td>
<td>13</td>
</tr>
<tr>
<td>Unterrichtssprache</td>
<td>English</td>
</tr>
<tr>
<td>Dauer</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Turnus</td>
<td>jedes Wintersemester</td>
</tr>
<tr>
<td>Modulkoordinator</td>
<td>Prof. Dr. Thomas Mertens</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>Prof. Dr. Thomas Mertens and supervisors of the practical part of the block „Infectious Diseases and Immune Defense“</td>
</tr>
</tbody>
</table>

Einordnung in die Studiengänge
Lecture, practical training and seminar of the block „Infectious diseases and immune defense“, 3rd semester

Vorkenntnisse
Basic knowledge of the immune system, of bacteria and viruses (e.g. principles of structure, replication and pathogenesis), of infectious diseases and their detection and treatment

Lernziele

Learning targets:
students should know mechanisms of pathogen (bacteria and viruses) and host interactions, e.g. how pathogen are sensed by the immune system and reactions of the immune system, mechanisms of pathogenicity of selected infectious diseases; they should be able to name important human pathogens and their characteristics

Scientific skills:
students should be able to use their knowledge from text books, scientific literature or other sources to develop ideas and hypothesis to answer unsolved questions connected to infectious diseases.

Relevance of the module for the study program:
to give students scientific background on infectious diseases and to prepare them for their internships in respective laboratories

**Practical training:**

Students should work on a specific project related to “Infectious diseases and immune defense”

**Seminar:**

Students should present data, which they generated in the 4-weeks practical internship of the block. They also should present data, which they generated in a critical discussion with fellow students based on given problems.

---

<table>
<thead>
<tr>
<th>Inhalt</th>
<th>Lecture:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Principles of pathogen-host interactions and current methods to study this, principles of the immune response to pathogen and immune evasion mechanisms, principles of cellular defense mechanisms, detailed knowledge of selected pathogens</td>
</tr>
<tr>
<td></td>
<td>Practical training:</td>
</tr>
<tr>
<td></td>
<td>Practical work in a research group</td>
</tr>
<tr>
<td></td>
<td>Scientific work on a specific project</td>
</tr>
<tr>
<td></td>
<td>Presentation of the achieved data in the corresponding seminar</td>
</tr>
</tbody>
</table>

**Seminar:**

Oral presentations of all practical internships of the block

Critical discussions on the data

Problem based learning in small groups on given topics concerning Infectious Diseases and Immune Defense

---

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bakteriology english: GJ Tortora, “Microbiology” 12th Edition</td>
</tr>
<tr>
<td></td>
<td>further literature to be announced</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, practical training, seminar, problem based learning</th>
</tr>
</thead>
</table>

**Arbeitsaufwand**

Lecture:

~45 h (15h attendance, ~30h self-dependent study time)
practical training:
~ 140h attendance (4 weeks fulltime)

seminar:
~ 30h attendance + preparation of the talks

**Bewertungsmethode**  The module will be passed once the Lecture, the Practical Training and the Seminar have been passed.

- Lecture: knowledge is examined during the practical training, 1 LP
- Practical Training: evaluation of the practical performance, 9 LP
- Seminar: oral presentation, 2 LP

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

**Grundlage für**  further practical trainings, practical master´s thesis
**Molecular Oncology**

Modul zugeordnet zu Block

**Code** 8810772133

**ECTS-Punkte** 12

**Präsenzzeit** 13

**Unterrichtssprache** English

**Dauer** 1 Semester

**Turnus** jedes Sommersemester

**Modulkoordinator** Prof. Dr. Lars Bullinger, Prof. Dr. Christian Buske

**Dozent(en)** responsible lecturers: Prof. Dr. Lars Bullinger, Prof. Dr. Christian Buske

**Einordnung in die Studiengänge** Lecture, practical training and seminar of the block „Molecular Oncology“, 2nd semester

**Vorkenntnisse**

Lecture:
- Basic knowledge in cancer biology
- Practical training:
- Basic knowledge of scientific research and laboratory methods
- Seminar:
- Basic knowledge of scientific research

**Lernziele**

Lecture:
- Learning targets:
- Deepened knowledge in the topics of cancer research and oncology
- Scientific skills:
- Theoretical skills for the practical part
- Relevance of the module for the study programme:
- Theoretical part of the block „Molecular Oncology“
Practical training:

Students should work on a specific project related to “Infectious diseases and immune defense”

Seminar:

Students should present data, which they generated in the 4-weeks practical internship of the block. They also should present data, which they generated in a critical discussion with fellow students based on given problems.

Inhalt

Lecture:

The students will get a solid theoretical background in the general principals of deregulated pathways in cancer cells based on the seminal reviewer article by Weinberg on the Hallmarks of Cancer. In brief, the students will learn about genomic, molecular genomic, epigenomics, transcriptomic and proteomic changes in cancer cells. In parallel, the lectures will also cover novel technological advances to examine all of these pathomechanisms. Students will receive a broad overview of state of the art technologies used to study cancer including novel NGS technologies, Proteomics approaches, as well as novel genetic engineering approaches using CRISPR/Cas9 technology. Furthermore, the students will be able to acquire a basic knowledge for the use of xenograft and genetically altered animal models in cancer research and they will gain some basic information on the most prevalent cancer types with a focus on the tumor entities studied at Ulm (Leukemia, Lymphoma, Pancreas Carcinoma, Breast Cancer, etc.).

Practical training:

Practical work in a research group

Scientific work on a specific project

Presentation of the achieved data in the corresponding seminar

Seminar:

Oral presentations of all practical internships of the block

Critical discussions on the data

Problem based learning in small groups on given topics concerning Infectious Diseases and Immune Defense

Literatur


Lehr- und Lernformen

Lecture, practical training, seminar, problem based learning

Arbeitsaufwand

Lecture:

~45 h (15h attendance, ~30h self-dependent study time)
practical training:
~ 140h attendance (4 weeks fulltime)

seminar:
~ 30h attendance + preparation of the talks

**Bewertungsmethode** The module will be passed once the Lecture, the Practical Training and the Seminar have been passed.

- Lecture: knowledge is examinated during the practical training, 1 LP
- Practical Training: evaluation of the practical performance, 9 LP
- Seminar: oral presentation, 2 LP

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

**Grundlage für**
- further practical courses
- practical master´s thesis
Signaling Pathways in Stem Cells, Development and Aging
Modul zugeordnet zu Block

**Code**  
8810772135

**ECTS-Punkte**  
12

**Präsenzzeit**  
13

**Unterrichtssprache**  
English

**Dauer**  
1 Semester

**Turnus**  
jedes Wintersemester

**Modulkoordinator**  
Prof. Dr. Michael Kühl

**Dozent(en)**  
Prof. Dr. Michael Kühl and persons offering practical training courses of this block

**Einordnung in die Studiengänge**  
Lecture, practical training and seminar of the block „Signaling pathways in stem cells, development and aging“, 3rd semester

**Vorkenntnisse**

Lecture:
- Basic knowledge of molecular biology and cell biology, contents of the course “Current concepts in stem cell biology and regenerative medicine”
- Basic knowledge of the immune system, of bacteria and viruses (e.g. principles of structure, replication and pathogenesis), of infectious diseases and their detection and treatment
- Practical training:
- Basic knowledge of scientific research and laboratory methods

Seminar:
- Basic knowledge of scientific research

**Lernziele**

Lecture:
- Students should be able to:
  - describe the most important concepts in stem cell biology, developmental biology and aging processes
  - to identify and discuss current methods in developmental biology, stem cell biology, aging biology.
**Practical training:**

Students should work on a specific project related to “Infectious diseases and immune defense”

**Seminar:**

Students should present data, which they generated in the 4-weeks practical internship of the block. They also should present data, which they generated in a critical discussion with fellow students based on given problems.

<table>
<thead>
<tr>
<th>Inhalt</th>
<th>Lecture:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>principles of regenerative medicine, principles of organogenesis, principles of signal transduction, embryonic and adult stem cells, induced pluripotent stem cells, organismal regeneration, molecular mechanisms underlying aging, current methods to study development and aging</td>
</tr>
<tr>
<td></td>
<td>Practical training:</td>
</tr>
<tr>
<td></td>
<td>Practical work in a research group</td>
</tr>
<tr>
<td></td>
<td>Scientific work on a specific project</td>
</tr>
<tr>
<td></td>
<td>Presentation of the achieved data in the corresponding seminar</td>
</tr>
<tr>
<td></td>
<td>Seminar:</td>
</tr>
<tr>
<td></td>
<td>Oral presentations of all practical internships of the block</td>
</tr>
<tr>
<td></td>
<td>Critical discussions on the data</td>
</tr>
<tr>
<td></td>
<td>Problem based learning in small groups on given topics concerning Infectious Diseases and Immune Defense</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Literatur</th>
<th>In English:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alberts et al. Molecular Biology of the Cell, Garland</td>
</tr>
<tr>
<td></td>
<td>Gilbert SF, Developmental Biology, Sinauer</td>
</tr>
<tr>
<td></td>
<td>Wolpert L, Principles of development, Oxford University Press</td>
</tr>
<tr>
<td></td>
<td>Stockum DL, Regenerative Biology and Medicine, Academic Press</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>In German:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nordheim A, Knippers R: Molekulare Genetik, Thieme</td>
</tr>
<tr>
<td></td>
<td>Kühl M, Kühl S, Stammzellbiologie, UTB</td>
</tr>
</tbody>
</table>
Kühl M, Gessert S, Entwicklungsbiologie, UTB

<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, practical training, seminar, problem based learning</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Arbeitsaufwand</th>
<th>Lecture:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>~45 h (15h attendance, ~30h self-dependent study time)</td>
</tr>
<tr>
<td></td>
<td>practical training:</td>
</tr>
<tr>
<td></td>
<td>~ 140h attendance (4 weeks fulltime)</td>
</tr>
<tr>
<td></td>
<td>seminar:</td>
</tr>
<tr>
<td></td>
<td>~ 30h attendance +preparation of the talks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bewertungsmethode</th>
<th>The module will be passed once the Lecture, the Practical Training and the Seminar have been passed.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Lecture: knowledge is examined during the practical training, 1 LP</td>
</tr>
<tr>
<td></td>
<td>• Practical Training: evaluation of the practical performance, 9 LP</td>
</tr>
<tr>
<td></td>
<td>• Seminar: oral presentation, 2 LP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notenbildung</th>
<th>The grade of the module will be the average of the individual exam grades weighted by the credit points of the individual exams.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Grundlage für</th>
<th>- further practical courses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- practical master´s thesis</td>
</tr>
</tbody>
</table>
Trauma Research and Regenerative Medicine
Modul zugeordnet zu Block

**Code** 8810772134

**ECTS-Punkte** 12

**Präsenzzeit** 13

**Unterrichtssprache** English

**Dauer** 1 Semester

**Turnus** jedes Sommersemester

**Modulkoordinator** Prof. Dr. Markus Huber-Lang, Prof. Dr. Peter Radermacher

**Dozent(en)** Lecturers and supervisors of the practical part of the block „ Trauma research and regenerative medicine“, to be announced

**Einordnung in die Studiengänge** Lecture, practical training and seminar of the block „ Trauma research and regenerative medicine“, 2nd semester

**Vorkenntnisse**

- Lecture: Basic knowledge on the topic; Physiological Principals
- Practical training: Basic knowledge of scientific research and laboratory methods
- Seminar: Basic knowledge of scientific research

**Lernziele**

- Lecture: understanding the topics of the lectures

**Practical training:**

Students should work on a specific project related to „ Infectious diseases and immune defense“

- Seminar:
Students should present data, which they generated in the 4-weeks practical internship of the block. They also should present data, which they generated in a critical discussion with fellow students based on given problems.

<table>
<thead>
<tr>
<th>Inhalt</th>
<th>Lecture:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pathophysiology of Trauma</td>
</tr>
<tr>
<td></td>
<td>Principals of Trauma-Care</td>
</tr>
<tr>
<td></td>
<td>Pathophysiology of Shock</td>
</tr>
<tr>
<td></td>
<td>Principals of Shock Management</td>
</tr>
<tr>
<td></td>
<td>Pathophysiology of Sepsis</td>
</tr>
<tr>
<td></td>
<td>Sepsis Bundles</td>
</tr>
<tr>
<td></td>
<td>Role of Barrier Dysfunction for Multiple Organ Failure</td>
</tr>
<tr>
<td></td>
<td>Modelling of Trauma-Shock-Sepsis</td>
</tr>
<tr>
<td></td>
<td>Practical training:</td>
</tr>
<tr>
<td></td>
<td>Practical work in a research group</td>
</tr>
<tr>
<td></td>
<td>Scientific work on a specific project</td>
</tr>
<tr>
<td></td>
<td>Presentation of the achieved data in the corresponding seminar</td>
</tr>
<tr>
<td>Seminar:</td>
<td>Oral presentations of all practical internships of the block</td>
</tr>
<tr>
<td></td>
<td>Critical discussions on the data</td>
</tr>
<tr>
<td></td>
<td>Problem based learning in small groups on given topics concerning Infectious Diseases and Immune Defense</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Literatur</th>
<th>Damage- and pathogen-associated molecular patterns and alarmins: keys to sepsis?.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory shock</td>
<td>Polytrauma--pathophysiology and management principles.</td>
</tr>
</tbody>
</table>
Severe sepsis and septic shock.

Angus DC, van der Poll T.

The acute respiratory distress syndrome.
Matthay MA, Ware LB, Zimmerman GA.

Hyperoxia in intensive care, emergency, and peri-operative medicine: Dr. Jekyll or Mr. Hyde? A 2015 update.
Hafner S, Beloncle F, Koch A, Radermacher P, Asfar P.

Lehr- und Lernformen
Lecture, practical training, seminar, problem based learning

Arbeitsaufwand
Lecture:
~45 h (15h attendance, ~30h self-dependent study time)
practical training:
~ 140h attendance (4 weeks fulltime)
seminar:
~ 30h attendance +preparation of the talks

Bewertungsmethode
The module will be passed once the Lecture, the Practical Training and the Seminar have been passed.

- Lecture: knowledge is examinated during the practical training, 1 LP
- Practical Training: evaluation of the practical performance, 9 LP
- Seminar: oral presentation, 2 LP

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

Grundlage für
- further practical courses
- practical master’s thesis
Bioinformatics and Systems Biology
Modul zugeordnet zu Compulsory Modules

Code 8810772138

ECTS-Punkte 6

Präsenzzeit 6

Unterrichtssprache English

Dauer 1 Semester

Turnus jedes Wintersemester

Modulkoordinator Prof. Dr. Hans Armin Kestler

Dozent(en) Prof. Dr. Hans Armin Kestler, Prof. Dr. Michael Kühl, Prof. Dr. Lars Bullinger, Prof. Dr. Franz Oswald, Dr. Karlheinz Holzmann, Prof. Dr. Enno Ohlebusch, Jun. Prof. Medhanie Mulaw, Dr. Anna Dolnik, Dr. Alexander Groß, Dr. Johann Kraus, Dr. Ludwig Lausser, Dr. Eric Strång, Dr. Sebastian Wiese, Andre Burkovski, Axel Fürstberger, Florian Schmid, Lyn-Rouven Schirra

Einordnung in die Studiengänge Molecular Medicine MSc, first semester

Vorkenntnisse Basic knowledge of molecular biology and bioinformatics

Lernziele Students should be able to
- describe the most important concepts in bioinformatics and systems biology.
- apply, discuss and interpret state-of-the-art techniques out the field of bioinformatics and systems biology.
- interpret basic mathematical networks and models

Inhalt principles of molecular biology, data mining techniques, sequence alignment, phylogenetic inference and structural analysis, signal transduction, pathway analysis, modeling- and reconstruction techniques


<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbeitsaufwand</td>
<td>~ 160 h (54h presence, ~108h self studies)</td>
</tr>
<tr>
<td>Bewertungsmethode</td>
<td>The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.</td>
</tr>
<tr>
<td>Notenbildung</td>
<td>The grade of the module will be the grade of the exam.</td>
</tr>
<tr>
<td>Grundlage für</td>
<td>not applicable</td>
</tr>
</tbody>
</table>
Clinical Trials and Project Management and Funding
Modul zugeordnet zu Compulsory Modules

Code 8810772142

ECTS-Punkte 6

Präsenzzeit 4

Unterrichtssprache English

Dauer 1 Semester

Turnus jedes Wintersemester

Modulkoordinator
Clinical Trials: Prof. Dr. Rainer Muche
Project Management and Funding: PD Dr. Dieter Brockmann, PD Dr. Petra Pandur

Dozent(en)
Clinical Trials: Dr. Benjamin Mayer, Dr. Kathrin Hohl
Project Management and Funding: PD Dr. Dieter Brockmann, PD Dr. Petra Pandur

Einordnung in die Studiengänge Module of the 3rd semester, Master study program Molecular Medicine

Vorkenntnisse BSc degree in life sciences

Lernziele

Clinical Trials:
Students should be able to know the general outline of clinical drug development and to sum up the main steps in planning, conducting, analyzing and reporting clinical trials. They learn the rationale and importance of randomization and blinding as well as distinguishing between different analysis collectives. Furthermore, students are familiar with the cornerstones of evidence based medicine.

The module intends to impart the basic skills in planning, analyzing, reporting and appraising clinical trials. These skills are of elementary importance in order enable future researchers to evaluate scientific findings appropriately.

Project Management and Funding:
Students should be able to explain different phases of project management, know the different types of research projects and understand the different levels of complexity in their management. Students should be able to estimate the budget...
of a research project. Students should get an idea of proper communication and conflict management. Students should improve their writing skills and understand the crucial aspects of writing a winning grant proposal.

Inhalt

Clinical Trials:
Planning a clinical trial; aspects of performing a trial; aspects of data management and analysis of a trial; reporting and appraising clinical trials; application to examples in early clinical trials

Project Management and Funding:
Phases and levels of project management, types of research projects and their management, communication, conflict management, writing grant proposals

Literatur

Clinical Trials:
D. Machin, M.J. Campbell. Design of studies for medical research, Wiley 2005
D. Wang, A. Bakhai: Clinical Trials, Remedica, 2005

Project Management and Funding:
Is provided during the course and may be subject to change, lecture slides are provided as a handout

Lehr- und Lernformen

Clinical Trials:
Lectures, practical exercises, oral presentation of each student

Project Management and Funding:
Seminar (students are encouraged to ask questions and contribute their thoughts to discussions)

Arbeitsaufwand

~ 60h attendance, ~120 preparation and learning time

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

Notenbildung
The grade of the module will be the grade of the exam.
Grundlage für Further work in labs and on projects
Current Concepts in Stem Cell Biology and Regenerative Medicine
Modul zugeordnet zu Compulsory Modules

Code 8810772137

ECTS-Punkte 6

Präsenzzeit 6

Unterrichtssprache English

Dauer 1 Semester

Turnus jedes Wintersemester

Modulkoordinator Prof. Dr. Michael Kühl

Dozent(en) Prof. Dr. Michael Kühl, Prof. Dr. Gilbert Weidinger, Jun. Prof. Dr. Steffen Just, Prof. Dr. Jan Tuckermann, PD Dr. Petra Pandur, PD Dr. Melanie Philipp

Einordnung in die Studiengänge Molecular Medicine MSc, first semester

Vorkenntnisse Basic knowledge of molecular biology and cell biology

Lernziele Students should be able to
- describe the most important concepts in stem cell biology and regenerative medicine with respect to basic science as well as potential therapeutic use.
- Students should be able to present, discuss and access current research in the field of stem cell biology and regenerative medicine.
- Students should be able to discuss current concepts of stem cell biology with respect to ethical aspects.

Inhalt principles of regenerative medicine, principles of embryonic development, principles of signal transduction, embryonic and adult stem cells, induced pluripotent stem cells, direct reprogramming, ethics in stem cell biology, organismal regeneration

Literatur In English;
Alberts et al. Molecular Biology of the Cell, Garland
Stockum DL, Regenerative Biology and Medicine, Academic Press


In German:
Nordheim A, Knippers R: Molekulare Genetik, Thieme
Kühl M, Kühl S, Stammzellbiologie, UTB
Kühl M, Gessert S, Entwicklungsbiologie, UTB

And yearly changing literature as given in the list of seminar topics

<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbeitsaufwand</td>
<td>~ 160 h</td>
</tr>
<tr>
<td>Bewertungsmethode</td>
<td>The module will be passed once the written exam and the oral presentation have been passed.</td>
</tr>
<tr>
<td>Notenbildung</td>
<td>The module grade is based on the grades of the written exam (75%) and the oral presentation (25%). The calculation of the module grade from the partial achievements is done by the examiner. The Transcript of Records shows only the overall module grade as an exam achievement.</td>
</tr>
<tr>
<td>Grundlage für</td>
<td>not applicable</td>
</tr>
<tr>
<td><strong>GLP/GSP and Bioethics</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td>Modul zugeordnet zu Compulsory Modules</td>
<td></td>
</tr>
<tr>
<td><strong>Code</strong></td>
<td>8810772141</td>
</tr>
<tr>
<td><strong>ECTS-Punkte</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Präsenzzeit</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Unterrichtssprache</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Dauer</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Turnus</strong></td>
<td>jedes Sommersemester</td>
</tr>
</tbody>
</table>
| **Modulkoordinator** | GLSP: PD Dr. Anke Witting, Dr. Hans-Peter Eckle  
Bioethics: Dr. Gisela Badura-Lotter |
| **Dozent(en)** | GLSP: PD Dr. Anke Witting, Dr. Hans-Peter Eckle  
Bioethics: Dr. Gisela Badura-Lotter + N.N. |
| **Einordnung in die Studiengänge** | Module of the 2nd semester, Master study program Molecular Medicine |
| **Vorkenntnisse** | None required |
| **Lernziele** | **GLSP:**  
After completion of the course students will have a basic knowledge of how to present scientific results in form of a paper. Students will be able to  
- know the basics about presentation formats  
- know the basics about scientific publishing  
- know how to prepare tables and figures  
- know how to write scientifically  
- know how to organize the different parts of papers  
- read efficiently papers  
- interpret scientific results  
- learn how to present data  
- learn how to scientifically discuss results |
- knowledge of the fundamental issues concerning scientific practice in
methological (working techniques) and historical-systematic point of view;
logic of scientific discovery and the practice of research
- elementary insight in contents and methods of modern empirical
sciences, in scientific techniques dealing with scientific literature
- critical awareness concerning the possibilities and limitations of scientific
practice (ethic of sciences)
- acquisition in competences concerning reflection and reasoning
- competences of knowledge-transformation and research
- competences regarding language, issues of social affairs and forms of
presentation
- working independently and teamwork (e.g. bibliography inquiries)
- informations about institutional research promotion

Bioethics:

Learning targets:
- Basics in philosophy of science, e.g. scientific truth and facts
- Norms and values of science
- Theoretical and historical foundations of biology, especially genetics
- Rhetoric and metaphors in science
- Historic development of genetics, human genetics and eugenics to current
medical genetics
- Basics in social studies of sciences, including laboratory studies
- Important ethical theories
- Current models of reasoning in biomedical ethics and research ethics

Scientific skills:
- Improved analytic abilities and critical thinking
- Understand, analyze and present scholarly texts
- Ability to critically reflect upon and discuss current biomedical research,
including its historical, social, and ethical dimension
- Test coherence and consistency of ethical arguments
- Apply basic types of ethical reasoning
- Be able to understand and analyze historical and philosophical articles in scientific journals

Relevance of the module for the study program:

compulsory subject, basic orientation about the ethical dimensions of scientific research, the role of science and scientist in contemporary medical and research policies, public outreach of science as well as social and political influence on research policies, topics, laws etc..

Inhalt

GLSP:

lecture: writing papers (Abstract, Title, Introduction, Material and Methods, Results (Tables and Figures), Discussion)

- seminar: study scientific papers (Figures and Tables and Interpretation) on recently published ones

- exemplary presentation and discussion of selected forms of epistemic working techniques

- introduction in scientific working techniques (e.g. bibliography inquiry [print and electronic medias])

- acquisition of information in the context of different medias and the question of information assessment

- composing epistemic publication

- introduction in the science of science and the theory of reasoning (induction, deduction, logic, statistics)

- the ethics of sciences and the science of ethics; fraud and deceit in sciences inflammatory pathways in neurodegenerative diseases

Bioethics:

Philosophy of science, e.g. positivism, falsification

- C.S. Peirce, K. Popper, J. Habermas, M. Foucault

Social studies of science, e.g. scientific norms, social construction of reality, laboratory work

- R. Merton, P. Berger/T. Luckmann, B. Latour

Basic ethics:

- Terms and definitions – general introduction

- Ethical theories (deontology, utilitarianism, virtue and pursuit ethics)

- Principles of biomedical ethics (Beauchamp and Childress)

Bioethics and research ethics:
- Problem types and their ethical domains in experimental and clinical settings (fundamental philosophical questions, biomedical ethics, animal ethics)

- Applying ethical theory to research problems (Kant, Bentham, Singer, Aristotle, Descartes)

- Current topics in biomedical and research ethics and models of their ethical analysis, e.g. genetic counseling, genetics in human reproduction, animal experimentation

- Concepts of Health and disease, medicalization processes

<table>
<thead>
<tr>
<th>Literatur</th>
<th>GLSP:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mimi Zeiger: “Essentials of writing biomedical research papers” McGraw-Hill Health Professions Division</td>
</tr>
<tr>
<td></td>
<td>Robert A. Day and Barbara Gastel: “How to write and publish a scientific paper” Greenwood Press</td>
</tr>
<tr>
<td></td>
<td>Michael Jay Katz: “From research to manuscript” Springer</td>
</tr>
<tr>
<td></td>
<td>Margaret Cargill and Patrick O’Coonor: “Writing scientific research Articles” Wiley-Blackwell</td>
</tr>
</tbody>
</table>

| Bioethics: |
| Philosophy of science, e.g. positivism, falsification |
| • S C. S. Peirce, K. Popper, J. Habermas, M. Foucault |
| Social studies of science, e.g. scientific norms, social construction of reality, laboratory work |
| • R. Merton, P. Berger/T. Luckmann, B. Latour |
| Basic ethics: |
| • Terms and definitions – general introduction |
| • Ethical theories (deontology, utilitarianism, virtue and pursuit ethics) |
| • Principles of biomedical ethics (Beauchamp and Childress) |

| Bioethics and research ethics: |
| • Problem types and their ethical domains in experimental and clinical settings (fundamental philosophical questions, biomedical ethics, animal ethics) |
| • Applying ethical theory to research problems (Kant, Bentham, Singer, Aristotle, Descartes) |
| • Current topics in biomedical and research ethics and models of their ethical analysis, e.g. genetic counseling, genetics in human reproduction, animal experimentation |
| • Concept of Health and disease, medicalization processes |

<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbeitsaufwand</td>
<td>~ 60h attendance, ~120 preparation and learning time</td>
</tr>
</tbody>
</table>
Bewertungsmethode  The grade of the module will be the grade of the written exam. No prerequisites are necessary for exam registration.

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

Grundlage für  Further work in labs and on projects
New Drug Discovery, Development and Evaluation
Modul zugeordnet zu Compulsory Modules

Code 8810772139

ECTS-Punkte 5

Präsenzzeit 4

Unterrichtssprache English

Dauer 1 Semester

Turnus jedes Wintersemester

Modulkoordinator Prof. Dr. Peter Gierschik

Dozent(en)
Holger Barth, Prof. Dr., Institute of Pharmacology and Toxicology, Ulm University Medical Center

Boris Ferger, Prof. Dr., Boehringer Ingelheim Pharma GmbH & Co. KG, Biberach, CNS Diseases

Peter Gierschik, Prof. Dr., Institute of Pharmacology and Toxicology Ulm University Medical Center

Ralf Heilker, PD Dr., Boehringer Ingelheim Pharma GmbH & Co. KG, Biberach, Lead Discovery

Stefan Hörrer, Dr., Boehringer Ingelheim Pharma GmbH & Co. KG, Biberach, Lead Identification and Optimization Support

Norbert Kraut, Prof. Dr., Boehringer Ingelheim RCV GmbH & Co KG, Vienna, Austria, Oncology Research

Jan Kriegl, Dr., Boehringer Ingelheim Pharma GmbH & Co KG, Biberach, Lead Discovery

Christian Lenk, PD Dr., Ethics Committee, Ulm University, and Institute of the History, Philosophy, and Ethics of Medicine, Ulm University

Barbara Moepps, PD Dr., Institute of Pharmacology and Toxicology, Ulm University Medical Center

Jan Münch, Prof. Dr., Institute of Molecular Virology, Ulm University Medical Center

Herbert Nar, Dr., Boehringer Ingelheim Pharma GmbH & Co. KG, Biberach, Lead Discovery
Richard F. Schlenk, Prof. Dr., Department of Internal Medicine III, Ulm University Medical Center

Thomas Simmet, Prof. Dr., Institute of Pharmacology of Natural Products and Clinical Pharmacology, Ulm University Medical Center

Tatjana Syrovets, Prof. Dr., Institute of Pharmacology of Natural Products and Clinical Pharmacology, Ulm University Medical Center

Oliver Zolk, Prof. Dr., Institute of Pharmacology of Natural Products and Clinical Pharmacology, Ulm University Medical Center

Tanja Weil, Prof. Dr., Institute of Organic Chemistry III, Ulm University

Heike A. Wieland, Prof. Dr., Sanofi-Aventis Deutschland GmbH, Frankfurt, Prospective and Strategic Initiatives, Partnering and Scouting

Sebastian Wiese, Dr., Core Unit Mass Spectrometry and Proteomics, Medical Faculty, Ulm University Medical Center

Einordnung in die Studiengänge
- Basic lecture of the first semester

Vorkenntnisse
- Understanding of basic principles in pharmacology and toxicology

Lernziele
- **Learning targets:**
  - Understanding the academic aspects of the discovery, development, and evaluation of new drugs (as opposed to understanding of the pharmacology and toxicology of known drugs)

- **Scientific skills:**
  - Presentation and discussion of important new findings and principles in the field of new drug discovery, development, and evaluation

- **Relevance of the module for the study programme:**
  - The science of new drug discovery, development, and evaluation is of central importance to the field of molecular medicine. Knowledge in this field prepares students for the future jobs in- and outside of academia.

Inhalt
- "Drug Safety and Toxicology"
- "Animal Models of Disease States"
- "General Aspects of New Drug Discovery, Development, and Evaluation"
- "Novel Drug Targets"
- "In Vitro Screening Systems"
- "Protein crystallography in the Pharmaceutical Industry"
- "Key Drivers of Biomedical Innovation in Cancer Drug Discovery"
- "High-Performance Computing in Drug Discovery"
- "Ethics Committees in New Drug Evaluation"
<table>
<thead>
<tr>
<th>Topic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Research Ethics&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Design of Clinical Trials&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Ethical Aspects of Research on Biomaterials&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Preclinical Drug Attrition and Postmarketing Drug Failure&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Novel Peptide Drugs from Peptide Libraries&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;The Role of Structural Biology and Biophysics in Drug Discovery&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Receptor Ligand Binding Kinetics: Relevance for Drug Discovery&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Clinical Trials in Oncology&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;New Drugs from Natural Sources&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Drug Targets Addressed by Natural Products and Drugs&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Pharmacogenetic Aspects of Drug Therapy&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Stratified/Personalized Drug Treatment&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Regulatory Aspects of Drug Development and Evaluation: ICH Guidelines&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Genetic Marker Development&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Emerging Concepts in Medicinal Chemistry&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;The Making of … Academic/Biotech-Pharma Deals&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Mass Spectrometry and Proteomics in Drug Discovery - Pharmacodynamic Biomarkers of Drug Action&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Literatur**

Is provided on the password-protected website (5 to 12 articles per lecture as suggested reading list)

**Lehr- und Lernformen**

Lecture

**Arbeitsaufwand**

About 100 h (attendance and self-study activities, e.g. following the suggested reading and preparing the poster for the minisymposium and its presentation)

**Bewertungsmethode**

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

**Notenbildung**

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

**Grundlage für**

not applicable
Practical Training in Laboratory Methods and Correlative Imaging
Modul zugeordnet zu Compulsory Modules

<table>
<thead>
<tr>
<th>Code</th>
<th>8810772140</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS-Punkte</td>
<td>13</td>
</tr>
<tr>
<td>Präsenzzeit</td>
<td>13</td>
</tr>
<tr>
<td>Unterrichtssprache</td>
<td>English</td>
</tr>
<tr>
<td>Dauer</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Turnus</td>
<td>jedes Wintersemester</td>
</tr>
<tr>
<td>Modulkoordinator</td>
<td>Prof. Dr. Thomas Mertens</td>
</tr>
</tbody>
</table>

Dozent(en)

Correlative Imaging:
Prof. Dr. Paul Walther, Prof. Dr. Meinrad Beer, Prof. Dr. Ambros Beer, Prof. Dr. Kay Gottschalk, Prof. Dr. Volker Rasche, Dr. Angelika Rück, Prof. Dr. Herbert Schneckenburger (HS Aalen), PD Dr. Andreas Wunder (Firma Boehringer Ingelheim, Biberach), PD Dr. Heiko Niessen (Firma Boehringer Ingelheim, Biberach), Prof. Dr. Gerhard Glatting, Dr. Alireza Abaei

Laboratory Methods:
Jun.-Prof. Dr. Jens von Einem, Dr. Katrin Lindenberg, Prof. Dr. Steffen Just, Prof. Dr. Stefan Britsch, Prof. Dr. Uwe Knippschild, Dr. Giada Frascaroli, Dr. Diana Lieber, Dr. Axel Schubert, Dr. Zeguang Wu, Dr. Björn von Einem, Dr. Christoph Wiegrefe, Dr. Joachim Bischof, Dr. Pengfei Xu

Einordnung in die Studiengänge
Parts of the module “Practical Training in Laboratory Methods and Correlative Imaging”, 1st semester Master study program Molecular Medicine

Vorkenntnisse
Correlative Imaging:
Basic knowledge of scientific research and imaging methods
Laboratory Methods:
Basic knowledge of scientific research

Lernziele
Correlative Imaging:
Students should learn:
different imaging application methods from molecular to macroscopic level including the theoretical knowledge

Students should be able to:

use the instructed methods

Laboratory Methods:

Students should learn:

Basic and advanced laboratory methods

Students should be able to:

Take part in the 4-weeks practical internships of the blocks in the 2nd and 3rd semester and work self-dependent on own projects

**Inhalt**

Correlative Imaging:

Different Imaging applications:

General application methods, pre-clinical applications, light microscopy, STM/AFM, electron microscopy, radiologic applications, nuclear medical applications, molecular imaging and drug development

Laboratory Methods:

Methods:

Cell culture, transfection, overexpression of proteins, western blot, immune fluorescence microscopy, DNA isolation, PCR, RT-PCR, immune fluorescence staining of cells, protein knock down by siRNA, cell sorting, experiments with the zebrafish model organism, genotyping and LacZ-staining of mouse embryos, cloning, transformation of DNA into bacteria cells

**Literatur**

Correlative Imaging:

Current literature concerning the used methods, to be announced before each course

Laboratory Methods:

Current literature concerning the used methods, to be announced before each course

**Lehr- und Lernformen**

Correlative Imaging:

Practical training, corresponding lectures

Laboratory Methods:

Practical training, seminars

**Arbeitsaufwand**

Correlative Imaging:

70h attendance, additionally preparation time and self-dependent study time
Laboratory Methods:

140h attendance, additionally preparation of the experiments and documentation of the results

**Bewertungsmethode**
The module will be passed once the written exam and the practical performance have been passed.

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

**Grundlage für**
- Practical internships of the blocks in the 2nd and 3rd semester
- practical master’s thesis
Master's Thesis and Disputation
Modul zugeordnet zu Master Thesis

<table>
<thead>
<tr>
<th>Code</th>
<th>8810780000</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS-Punkte</td>
<td>30</td>
</tr>
<tr>
<td>Präsenzzeit</td>
<td>keine Angaben</td>
</tr>
<tr>
<td>Unterrichtssprache</td>
<td>English</td>
</tr>
<tr>
<td>Dauer</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Turnus</td>
<td>keine Angaben</td>
</tr>
<tr>
<td>Modulkoordinator</td>
<td>Lecturer of Ulm University</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>N.N.</td>
</tr>
</tbody>
</table>

Einordnung in die Studiengänge: Practical project as final thesis, 4th semester

Vorkenntnisse: Basic knowledge of scientific research, lab methods and scientific writing

Lernziele: Students should work on specific scientific topic, write a thesis and defend their data in an oral exam

Inhalt:
- Scientific project
- Critical discussions of the data in the Progress Report
- Enhancement of the knowledge in Journal Clubs
- Writing a scientific thesis containing the achieved data
- Presentation of the data in an oral disputation

Literatur: Current papers concerning the research topic

Lehr- und Lernformen:
- Practical work in the lab
- Discussions in research groups
<table>
<thead>
<tr>
<th>Arbeitsaufwand</th>
<th>Fulltime attendance + preparation of the thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bewertungsmethode</strong></td>
<td>The module will be passed once the Master thesis and the oral examination have been passed.</td>
</tr>
<tr>
<td>• Master thesis: written expertises of 2 supervisors</td>
<td></td>
</tr>
<tr>
<td>• Disputation: oral examination</td>
<td></td>
</tr>
<tr>
<td><strong>Notenbildung</strong></td>
<td>The module grade is based on the grades of the master thesis (50%) and the disputation (50%). The calculation of the module grade from the partial achievements is done by the examiner. The Transcript of Records shows only the overall module grade as an exam achievement.</td>
</tr>
<tr>
<td><strong>Grundlage für</strong></td>
<td>Final degree</td>
</tr>
</tbody>
</table>