Modulhandbuch

Master of Science Molekulare Medizin

Prüfungsordnungsversion 2017
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Infectious Diseases and Immune Defense
Modul zugeordnet zu Practical Modules

<table>
<thead>
<tr>
<th>Code</th>
<th>8810772136</th>
</tr>
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<tbody>
<tr>
<td>ECTS-Punkte</td>
<td>12</td>
</tr>
<tr>
<td>Präsenzzeit</td>
<td>14</td>
</tr>
<tr>
<td>Unterrichtsprache</td>
<td>English</td>
</tr>
<tr>
<td>Dauer</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Turnus</td>
<td>jedes Sommersemester</td>
</tr>
<tr>
<td>Modulkoordinator</td>
<td>Prof. Dr. Michael Kühl (on an interim base)</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>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“, 2nd 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.

For the practical part: participation in the course "Practical Training in Laboratory Methods" (1st semester)

Lernziele
Lecture:
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.

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<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>
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<td>Scientific work on a specific project</td>
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<td></td>
<td>Presentation of the achieved data in the corresponding seminar</td>
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<td>Seminar:</td>
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<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>
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<tr>
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<tbody>
<tr>
<td></td>
<td>Bakteriology englisch: GJ Tortora, “Microbiology” 12th Edition</td>
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<tr>
<td></td>
<td>further literature to be announced</td>
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<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, practical training, seminar, problem based learning</th>
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<table>
<thead>
<tr>
<th>Arbeitsaufwand</th>
<th>Lecture:</th>
</tr>
</thead>
</table>
~45 h (15h attendance, ~30h self-dependent study time)

practical training:
~ 140h attendance (4 weeks fulltime)

seminar:
~ 30h attendance + preparation of the talks

<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>
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</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>
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</thead>
<tbody>
<tr>
<td>Grundlage für</td>
<td>further practical trainings, practical master’s thesis</td>
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Molecular Oncology II
Modul zugeordnet zu Practical Modules

<table>
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<td>14</td>
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<td>English</td>
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<tr>
<td>Dauer</td>
<td>1 Semester</td>
</tr>
<tr>
<td>Turnus</td>
<td>jedes Wintersemester</td>
</tr>
<tr>
<td>Modulkooordinatoren</td>
<td>Dr. Mike-Andrew Westhoff</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>Dr. Mike-Andrew Westhoff, Prof. Dr. Georg Karpe-Massler, Dr. Ninel Azoitei</td>
</tr>
</tbody>
</table>

Einordnung in die Studiengänge
specialization of the study program Molecular Medicine

Vorkenntnisse
block "Molecular Oncology", 1st semester

Lernziele
deeper knowledge in the research field of oncology

Inhalt
The Molecular Oncology II module consists of five key learning units spread across 14 individual lectures.

1. Basic understanding and background
   - Here the students' knowledge on basic facts and underlying molecular mechanisms of cancer sciences and oncogenesis are further increased, following from the Molecular Oncology I module.
   - Here the transference of the knowledge gained so far to a research problem and the clinical situation is studied. The different tools and strategies implemented in laboratories and clinics are discussed and the progression from pre-clinical research to clinical trial (including detours) are elucidated.

2. Translation research
   - Here the students are given the opportunity to few problems encountered in cancer sciences from a non-traditional point of view, thus encouraging their creativity and the development of novel research strategies.

3. Thinking outside the box
   - Modern cancer science can not be understood without a basic knowledge of oncology as experienced by the clinicians. To deepen the understanding between researcher and clinician be encourage the students to develop a better understanding of the clinical reality and the problems faced by staff caring for cancer patients. Also, current treatment options and strategies are discussed.

4. Voices from the clinic
   - Critical thinking
   - This final unit, similarly to unit 3, concentrates on the transferable skills to be developed by the students.
discussing current controversies in cancer sciences and fake cures, we prepare the critical thinking skills of the students and further their abilities to independently assess novel situations presented to them. <p><strong>Practical training:</strong><p>Practical work in a research group <p>Scientific work on a specific project <p>Presentation of the achieved data in the corresponding seminar <p>Oral presentations of all practical internships of the block <p>Critical discussions on the data <p>Problem based learning in small groups on given topics concerning “Molecular Oncology” in a deepened version

<table>
<thead>
<tr>
<th>Literatur</th>
<th>current publications, to be announced up to date each year</th>
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<tr>
<td>Lehr- und Lernformen</td>
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<tr>
<td></td>
<td>Practical Training:</td>
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<tr>
<td></td>
<td>~ 140h attendance (4 weeks fulltime)</td>
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<tr>
<td></td>
<td>Seminar:</td>
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<td></td>
<td>~ 30h attendance + preparation of the talks</td>
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<tr>
<td>Bewertungsmethode</td>
<td>Die Vergabe der Leistungspunkte erfolgt aufgrund des Bestehens der Teilprüfungen zu Forschungspraktikum (Bewertung der praktischen Arbeiten), Seminar (mündliche Präsentation) und Vorlesung (mündliche Prüfung im Rahmen des Praktikums). Die Anmeldung zu diesen Prüfungen setzt keinen Leistungsnachweis voraus.</td>
</tr>
<tr>
<td>Notenbildung</td>
<td>Die Modulnote errechnet sich aus dem nach Leistungspunkten gewichteten Mittel der Ergebnisse der Modulteilprüfungen.</td>
</tr>
<tr>
<td>Grundlage für</td>
<td>specialization in &quot;Molecular Oncology&quot;</td>
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### Molecular Oncology
Modul zugeordnet zu Practical Modules

<table>
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<td>Turnus</td>
<td>jedes Sommersemester</td>
</tr>
<tr>
<td>Modulkoordinator</td>
<td>Dr. Mike-Andrew Westhoff</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>responsible lecturer: Dr. Mike-Andrew Westhoff</td>
</tr>
</tbody>
</table>

**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; participation in the module "Practical Training in Laboratory Methods" (1st semester)
- 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 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 courses
- practical master’s thesis
- specialization in "Molecular Oncology", participation in the block "Molecular Oncology II"
Signaling Pathways in Stem Cells, Development and Aging
Modul zugeordnet zu Practical Modules

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<tr>
<td>Modulkoordinator</td>
<td>Prof. Dr. Michael Kühl</td>
</tr>
<tr>
<td>Dozent(en)</td>
<td>Prof. Dr. Michael Kühl and persons offering practical training courses of this block</td>
</tr>
<tr>
<td>Einordnung in die Studiengänge</td>
<td>Lecture, practical training and seminar of the block „Signaling pathways in stem cells, development and aging“, 3rd semester</td>
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<tr>
<td>Vorkenntnisse</td>
<td>Lecture:</td>
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<tr>
<td></td>
<td>Basic knowledge of molecular biology and cell biology, contents of the course “Current concepts in stem cell biology and regenerative medicine”</td>
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<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>Practical training:</td>
</tr>
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<td></td>
<td>Basic knowledge of scientific research and laboratory methods</td>
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<td></td>
<td>Seminar:</td>
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<td>Basic knowledge of scientific research</td>
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<tr>
<td>Lernziele</td>
<td>Lecture:</td>
</tr>
<tr>
<td></td>
<td>Students should be able to:</td>
</tr>
<tr>
<td></td>
<td>- describe the most important concepts in stem cell biology, developmental biology and aging processes</td>
</tr>
<tr>
<td></td>
<td>- to identify and discuss current methods in developmental biology, stem cell biology, aging biology.</td>
</tr>
</tbody>
</table>
**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.

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**Inhalt**

**Lecture:**

- 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

**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

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**Literatur**

**In English:**

- Alberts et al. Molecular Biology of the Cell, Garland
- Gilbert SF, Developmental Biology, Sinauer
- Wolpert L, Principles of development, Oxford University Press
- Stockum DL, Regenerative Biology and Medicine, Academic Press

**In German:**

- Nordheim A, Knippers R: Molekulare Genetik, Thieme
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
### Trauma Research and Regenerative Medicine
Modul zugeordnet zu Practical Modules

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<td>12</td>
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<td><strong>Unterrichtssprache</strong></td>
<td>English</td>
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<tr>
<td><strong>Dauer</strong></td>
<td>1 Semester</td>
</tr>
<tr>
<td><strong>Turnus</strong></td>
<td>jedes Semester</td>
</tr>
<tr>
<td><strong>Modulkodiordinate</strong></td>
<td>Prof. Dr. Markus Huber-Lang, Prof. Dr. Peter Radermacher</td>
</tr>
<tr>
<td><strong>Dozent(en)</strong></td>
<td>Lecturers and supervisors of the practical part of the block „Trauma research and regenerative medicine“, to be announced</td>
</tr>
<tr>
<td><strong>Einordnung in die Studiengänge</strong></td>
<td>Lecture, practical training and seminar of the block „Trauma research and regenerative medicine“, 2nd+3rd semester</td>
</tr>
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</table>

**Vorkenntnisse**
- **Lecture:**
  Basic knowledge on the topic; Physiological Principals
- **Practical training:**
  Basic knowledge of scientific research and laboratory methods, participation in the module "Practical Training in Laboratory Methods" (1st semester)
  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>
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<tbody>
<tr>
<td></td>
<td>Pathophysiology of Trauma</td>
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<td>Principals of Trauma-Care</td>
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<td>Pathophysiology of Shock</td>
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<td>Principals of Shock Management</td>
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<td>Pathophysiology of Sepsis</td>
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<td>Sepsis Bundles</td>
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<td></td>
<td>Role of Barrier Dysfunction for Multiple Organ Failure</td>
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<td></td>
<td>Modelling of Trauma-Shock-Sepsis</td>
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<td></td>
<td>Practical training:</td>
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<td></td>
<td>Practical work in a research group</td>
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<td>Problem based learning in small groups on given topics concerning Infectious Diseases and Immune Defense</td>
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<table>
<thead>
<tr>
<th>Literatur</th>
<th>Damage- and pathogen-associated molecular patterns and alarmins: keys to sepsis?.</th>
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<tr>
<td></td>
<td><strong>Denk</strong> S, Perl M, <strong>Huber-Lang</strong> M.</td>
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<td></td>
<td>Polytrauma--pathophysiology and management principles.</td>
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<td><strong>Gebhard F</strong>, <strong>Huber-Lang</strong> M.</td>
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<tr>
<td></td>
<td>Langenbecks Arch Surg. 2008 Nov;393(6):825-31</td>
</tr>
<tr>
<td></td>
<td>Circulatory <strong>shock</strong>.</td>
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<tr>
<td></td>
<td><strong>Vincent JL</strong>, <strong>De Backer D</strong>.</td>
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</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
Bioethics, Philosophy and Good Practice of Science
Modul zugeordnet zu Compulsory Modules

**Code**
8810774636

**ECTS-Punkte**
6

**Präsenzzeit**
4

**Unterrichtssprache**
English

**Dauer**
1 Semester

**Turnus**
jedes Sommersemester

**Modulkoordinator**
Prof. Dr. Florian Steger (Bioethics part)
Dr. Hans-Peter Eckle (Good Practice of Science part)

**Dozent(en)**
PD Dr. Maximilian Schochow
Dr. Hans-Peter Eckle

**Einordnung in die Studiengänge**
Molecular Medicine, 2nd semester

**Vorkenntnisse**
one required

**Lernziele**

**Good Practice of Science: Scientific Writing**

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

Good Practice of Science: Responsible Conduct in Science

Learning targets:
   Relate fundamentals of bioethics and philosophy of science to scientific practice.

Scientific skills:

Consequences of philosophy in scientific practice:
- What is and what is not science? Logic of scientific discovery, relation between experimental investigation and construction of theories.
- Truth, knowledge and scientific reasoning: what is a scientific explanation?
- Logical argumentation, deductive and inductive reasoning and statistical inference

Issues of scientific conduct:
- Good and bad practices in collaborations/co-operations/co-authorship/scientific documentation/scientific publication/student-advisor relations/resolution of conflicts.
- Fraud and deceit in science
- What is scientific communication and how does it work, e.g. where and when does it start (and end)? Who are the various audiences? Scientific literature and information assessment, presentation of scientific results in various settings: informal discussion to invited conference talk.

Analysis of the scientific publication process: choosing a journal, the editorial process, peer review process, quality criteria: validity and scientific interest.

Seeking competent support, e.g. role of ombudsmen

Bioethics:

Learning targets:
- Basics in research ethics and medical ethics
- Application areas of bioethics
- Theories and methods of bioethics
- Focus on topics related to molecular medicine: Genome editing, moral status of the embryo, stem cells, cloning, etc.

Scientific skills:
- Apply basic types of ethical reasoning
- Understand, analyze and present topics of bioethics
- Ability to critically reflect upon and discuss current biomedical research
- Test coherence and consistency of ethical arguments

### Good Practice of Science: Scientific Writing

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

### Good Practice of Science: Responsible Conduct in Science

Analyze and critically reflect upon three subject areas, their mutual connections and their significance for the working scientist.

- What does it mean to do science and how is science done correctly? E.g. proper argumentation
- Ethical issues within the scientific process, e.g. questions of scientific conduct and misconduct
- General scientific skills and research tools, e.g. how to maintain a lab book, data documentation in general

### Bioethics:

- Introduction: What is bioethics? Mapping the field
- Research ethics and clinical human experimentation
- Medical ethics
- Animal testing
- Reproductive medicine
- Moral status of the embryo
- Stem cells
- Genome editing
- Cloning
- Genetic enhancement
- Genetic diagnosis
- Biobanks
- Eugenics
- Transhumanism
### Literatur

**Good Practice of Science: Scientific Writing**
- Mimi Zeiger: "Essentials of writing biomedical research papers" McGraw-Hill Health Professions Division
- Robert A. Day and Barbara Gastel: "How to write and publish a scientific paper" Greenwood Press
- Michael Jay Katz: "From research to manuscript" Springer
- Margaret Cargill and Patrick O’Coonor: "Writing scientific research Articles" Wiley-Blackwell

**Good Scientific Practice: Responsible conduct in Science**

Further literature will be distributed before and during the course

**Bioethics:**

### Lehr- und Lernformen

- Lecture, seminar

### Arbeitsaufwand

~ 60h attendance, ~120 preparation and learning time
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Bioinformatics and Systems Biology
Modul zugeordnet zu Compulsory Modules

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<td>Turnus</td>
<td>jedes Wintersemester</td>
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<tr>
<td>Modulkoordinator</td>
<td>Prof. Dr. Hans Armin Kestler</td>
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Dozent(en)
Prof. Dr. Hans Armin Kestler, Prof. Dr. Michael Kühl, 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 Sträng, 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

Literatur


<table>
<thead>
<tr>
<th>Lehr- und Lernformen</th>
<th>Lecture, Exercises</th>
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<tr>
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Clinical Trials and Project Management and Funding
Modul zugeordnet zu Compulsory Modules

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<td>jedes Wintersemester</td>
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</table>
| Modulkoordinator    | Clinical Trials: Prof. Dr. Rainer Muche  
Project Management and Funding: PD Dr. Petra Pandur, PD Dr. Daniel Mertens |
| Dozent(en)          | Clinical Trials: Dr. Benjamin Mayer, Dr. Kathrin Hohl  
Project Management and Funding: PD Dr. Daniel Mertens, PD Dr. Petra Pandur |
| Einordnung in die   | Module of the 3rd semester, Master study program Molecular Medicine |
| Studiengänge        |            |
| 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 8810774635

ECTS-Punkte 6

Präsenzzeit 4

Unterrichtssprache English

Dauer 1 Semester

Turnus jedes Wintersemester

Modulkоordinator 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, Prof. Dr. Melanie Philipp

Einordnung in die Studiengänge Molecular Medicine, MSc, 1st 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>
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### New Drug Discovery, Development and Evaluation
Modul zugeordnet zu Compulsory Modules

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<td>Modulkooordinator</td>
<td>Prof. Dr. Peter Gierschik</td>
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<table>
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<th>Dozent(en)</th>
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<tbody>
<tr>
<td>Holger Barth, Prof. Dr., Institute of Pharmacology and Toxicology, Ulm University Medical Center</td>
</tr>
<tr>
<td>Boris Ferger, Prof. Dr., Boehringer Ingelheim Pharma GmbH &amp; Co. KG, Biberach, CNS Diseases</td>
</tr>
<tr>
<td>Peter Gierschik, Prof. Dr., Institute of Pharmacology and Toxicology Ulm University Medical Center</td>
</tr>
<tr>
<td>Ralf Heilker, PD Dr., Boehringer Ingelheim Pharma GmbH &amp; Co. KG, Biberach, Lead Discovery</td>
</tr>
<tr>
<td>Stefan Hörrer, Dr., Boehringer Ingelheim Pharma GmbH &amp; Co. KG, Biberach, Lead Identification and Optimization Support</td>
</tr>
<tr>
<td>Norbert Kraut, Prof. Dr., Boehringer Ingelheim RCV GmbH &amp; Co KG, Vienna, Austria, Oncology Research</td>
</tr>
<tr>
<td>Jan Kriegl, Dr., Boehringer Ingelheim Pharma GmbH &amp; Co. KG, Biberach, Lead Discovery</td>
</tr>
<tr>
<td>Christian Lenk, PD Dr., Ethics Committee, Ulm University, and Institute of the History, Philosophy, and Ethics of Medicine, Ulm University</td>
</tr>
<tr>
<td>Barbara Moepps, PD Dr., Institute of Pharmacology and Toxicology, Ulm University Medical Center</td>
</tr>
<tr>
<td>Jan Münch, Prof. Dr., Institute of Molecular Virology, Ulm University Medical Center</td>
</tr>
<tr>
<td>Herbert Nar, Dr., Boehringer Ingelheim Pharma GmbH &amp; Co. KG, Biberach, Lead Discovery</td>
</tr>
<tr>
<td>Richard F. Schlenk, Prof. Dr., Department of Internal Medicine III, Ulm University Medical Center</td>
</tr>
</tbody>
</table>
Einordnung in die Studiengänge

Basic lecture of the first semester Molecular Medicine, MSc

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" "Research Ethics" "Design of Clinical Trials"

"Ethical Aspects of Research on Biomaterials"
"Preclinical Drug Attrition and Postmarketing Drug Failure"

"Novel Peptide Drugs from Peptide Libraries"

"The Role of Structural Biology and Biophysics in Drug Discovery" "Receptor Ligand Binding Kinetics: Relevance for Drug Discovery"

"Clinical Trials in Oncology"

"New Drugs from Natural Sources"

"Drug Targets Addressed by Natural Products and Drugs"


"The Making of … Academic/Biotech-Pharma Deals"

"Mass Spectrometry and Proteomics in Drug Discovery - Pharmacodynamic Biomarkers of Drug Action"

**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**

keine Angabe

**Notenbildung**

keine Angabe

**Grundlage für**

further study program
Practical Training in Laboratory Methods and Correlative Imaging
Modul zugeordnet zu Compulsory Modules

**Code** 8810772140

**ECTS-Punkte** 13

**Präsenzzeit** 13

**Unterrichtssprache** English

**Dauer** 1 Semester

**Turnus** jedes Wintersemester

**Modulkoordinator** Prof. Dr. Michael Kühl

**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. Björn von Einem, Dr. Christoph Wiegreffe, 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**

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

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**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

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**Lehr- und Lernformen**

Correlative Imaging:

Practical training, corresponding lectures

Laboratory Methods:

Practical training, seminars

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**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 including Journal Club and Progress Report

Modul zugeordnet zu Master’s Thesis

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<td>Einordnung in die Studiengänge</td>
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<tr>
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