**Modulhandbuch M.Sc. Biologie**  
**Schwerpunktmodule II**

### Titel des Moduls: Developmental Biology

Schwerpunktmodul II (M.Sc.) SP2-07

### Modulverantwortlicher: Neubüser, Annette

### Fachbereich(e): Developmental Biology

### Typ: Wahlpflichtmodul

### Fachsemester: 3

### Moduldaure: 1 Semester, Block

### ECTS: 21

### Turnus: Winter semester

### Workload: 630 h

### Empfohlene Voraussetzung: WM-12

### Zwingende Voraussetzung: OM-02, SP1-02

### Verwendbarkeit: M.Sc. Biology, Major Genetics & Developmental Biology

### Lehrende:

Baumeister, Ralf / Driever, Wolfgang / Driller, Katrin / Gastdozenten / Holzschuh, Jochen / Lecaudey, Virginie / Neubüser, Annette / Nitschke, Roland / Onichtchouk, Daria / Pyrowolakis, Giorgos / Schweitzer, Jörn

### Veranstaltungstitel, Lehrform, ECTS, SWS, Workload [h]

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<td>Lecture</td>
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<tr>
<td>From Genome to Organism: Molecular, Genetic and Cell Biology Approaches in Developmental Biology</td>
<td>Lecture</td>
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<td>Developmental Biology Lab Projects</td>
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<td>From Genes to Tissues and Organs</td>
<td>Seminar</td>
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### Lernziele / Lernergebnisse

Students can
- explain molecular mechanisms of embryonic development of model organism and their relevance to human disease
- integrate knowledge of several disciplines (developmental biology, genetics, cell biology) towards comprehension of complex developmental processes
- apply state-of-the-art technologies for research on embryonic development
- analyze their experiments using statistical tools and to evaluate their results critically.
- write a laboratory project report in the format of a primary scientific publication
- define the essential findings from a primary research publication in developmental biology, and explain, interpret and discuss them together with the experimental logic in a scientific presentation

### Studienleistung

- at least 80% physical presence during lectures, practical classes and seminars.
- active participation in lecture discussions, seminars and lab projects
- independent follow-up learning of the topics of lectures, seminars and lab projects.
- preparation of scientific standard protocols of laboratory projects

### Prüfungsleistung & Benotung

- Protocols of two laboratory projects written in the format of a primary scientific publication. Each protocol will be graded and contribute 30% to the module grade (thus, the protocols together contribute 60% of grade)
- Oral presentation (30 minutes) and exam (30 minutes) account for 40% of the total grade of the module.

### Literatur

- S.F. Gilbert: Developmental Biology 9th or 10th ed
- Scientific articles addressing selected topics (will be deposited on Illias)
**Veranstaltungscode:** Molecular Mechanisms of Development

**Lehrform:** Lecture

**Modul:** Schwerpunktmodul II „Developmental Biology“ SP2-07

**Verwendbarkeit:** Schwerpunktmodul II „Developmental Biology“

**Lehrsprache:** English

**Teilnehmerzahl:** 40

**Moduldauer:** 1 Semester, Block

**Fachsemester:** 3

**Angebotshäufigkeit:** winter semester only

### Inhalte

Selected topics in Developmental Biology will be presented and discussed starting at the advanced text book level and taking student to the most recent research results. Topics include:

- Control of cell behavior during gastrulation - links to stem cells and cancer
- Epigenetic control of stem cell fate during development
- Zygotic genome activation and pluripotency control
- Insulin signaling in Development and stem cells
- Organizers and morphogens in tissue patterning and growth
- Shared mechanisms of embryonic development and the genesis of cancer
- Neural crest and craniofacial development
- Mechanisms of organ assembly
- Asymmetries, axes, and cell fates in vertebrates
- Sex-specific alternative splicing in Drosophila

### Lehrmethoden und Medien

- Lectures using PowerPoint or Keynote presentations
- Handouts of lecture slides as PDFs on Illias server.
- Up-to-date scientific reviews for each topic provided on Illias server
- Development of schemes using chalk / board
- Discussion of concepts and open questions

### Lernziele / Lernergebnisse

The students are able to

- explain molecular mechanisms of embryonic development of model organism detail (including transcriptional control, signaling mechanisms)
- explain cellular mechanisms of embryonic development (e.g. EMT, cell migration, cell death) using examples
- integrate knowledge of several disciplines (developmental biology, genetics, cell biology) towards comprehension of complex developmental processes
- draw parallels between developmental processes and human diseases using example
- explain mechanisms of stem cell fate maintenance and stem cell differentiation with examples
- evaluate animal models and experimental approaches for research into development as well as developmental diseases and cancer

### Studienleistung

Independent follow-up learning of the topics of lectures using the lecture materials, text books and current scientific reviews

### Prüfungsleistung & Benotung

Topics of the lectures are topics of a 30 minute oral exam at the end of the module

### Literatur

- Gilbert, Developmental Biology (2013, 10th Ed)
- Primary literature and academic reviews as provided by lecturers

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<th>SWS</th>
<th>Präsenzstudium</th>
<th>Selbststudium</th>
<th>Workload Summe</th>
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<tr>
<td>1,5</td>
<td>22,5 h</td>
<td>22,5 h</td>
<td>45 h</td>
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**Veranstaltungstitel:** From Genome to Organism: Molecular, Genetic and Cell Biology Approaches in Developmental Biology

**Lehrform:** Lecture

**Modul:** Schwerpunktmodul II „Developmental Biology“ SP2-07

**Verwendbarkeit:** Schwerpunktmodul II „Developmental Biology“

**Lehrsprache:** English

**Teilnehmerzahl:** 40

**Moduldoer:** 1 Semester, Block

**Fachsemester:** 3

**Angebots-häufigkeit:** winter semester only

<table>
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<tr>
<th>SWS / LVS</th>
<th>Präsenzstudium</th>
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<tr>
<td>1</td>
<td>15 h</td>
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<td>30 h</td>
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**Inhalte**

Lecture series focusing on current methodology and technologies used in the field of developmental biology. Each lecture presents state of the art in a technology area.

- Extracting biological information using the genetic toolbox of model organisms including C. elegans, Drosophila, zebrafish, mouse
- Reverse Genetics in Zebrafish
- Genetic engineering in mice: Strategies to insert targeted mutations
- Genetic Engineering in mice: conditional mutagenesis and targeted gain-of-function studies
- Observing dynamical biological processes in vivo in model organisms
- Use of advanced microscopy methods to study cell biology
- Methods to detect apoptotic cell death
- Technologies for transcriptional regulatory network analysis
- From gene regulatory networks to virtual embryo: Integrating regulatory mechanisms at the systems level

**Lehrmethoden und Medien**

- Lectures using PowerPoint or Keynote presentations
- Handouts of lecture slides as PDFs on Illias server
- Up-to-date scientific reviews for each topic provided on Illias server
- Development of schemes using chalk / board
- Discussion of concepts and open questions

**Lernziele / Lernergebnisse**

- The students are able to:
  - explain current state-of-the-art techniques combining embryology, cellular and molecular approaches in developmental biology and developmental neurosciences
  - evaluate different genetic techniques for the manipulation of signaling pathways and transcriptional control and apply appropriate techniques in experiments
  - evaluate and apply pharmacological techniques for signaling pathway manipulation

**Studienleistung**

- independent follow-up learning of the topics of lectures using the lecture materials, text books and current scientific reviews

**Prüfungsleistung & Benotung**

- Topics of the lectures are topics of a 30 minute oral exam at the end of the module

**Literatur**

- Gilbert, Developmental Biology (2013, 10th Ed)
- Primary literature and academic reviews as provided by lecturers
**Veranstaltungstitel:** Developmental Biology Lab Projects  

**Lehrform:** Practical exercise  

**Modul:** Schwerpunktmodul II „Developmental Biology“  

**Verwendbarkeit:** Schwerpunktmodul II „Developmental Biology“  

**Lehrsprache:** English  

**Teilnehmerzahl:** 12  

**Moduldauer:** 1 Semester, Block  

**Fachsemester:** 3  

**Angebotshäufigkeit:** winter semester only  

**SWS / LVS**  

<table>
<thead>
<tr>
<th>Präsenzstudium</th>
<th>Selbststudium</th>
<th>Workload Summe</th>
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<tbody>
<tr>
<td>15</td>
<td>225 h</td>
<td>265 h</td>
</tr>
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<td>490 h</td>
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</tbody>
</table>

**Inhalte**  

Students perform two small research projects integrated into participating research laboratories in the field of developmental biology ("lab rotations of 4 weeks each"). At least one of the lab projects should contain molecular and cellular level analysis. Students learn how to develop and plan a project, apply current experimental approaches towards solution of a scientific question, and write a report in the format of a primary scientific publication.  

**Lehrmethoden und Medien**  

Instructions for practical work by faculty. Students perform experiments independently individually or in teams of two with support by teaching staff.  

**Lernziele / Lernergebnisse**  

Students can  
- develop and plan a small research project addressing a current question in developmental neurosciences  
- apply state-of-the-art technologies for research on developmental questions  
- analyze their experiments using statistical tools and to evaluate their results critically  
- write a laboratory project report in the format of a scientific primary research publication  

**Studienleistung**  

- at least 80% physical presence during time of lab projects.  
- active planning and experimental execution of lab projects.  
- preparation of scientific standard protocols of laboratory projects  

**Prüfungsleistung & Benotung**  

- Protocols of two laboratory projects written in the format of a primary scientific publication. Each protocol will be graded and contribute 30% to the module grade (thus, the protocols together contribute 60% of grade)  
- Oral presentation and exam: One of the two laboratory projects has to be presented in the format of a scientific presentation (30 minutes); the presentation is directly followed by a discussion and exam (also 30 minutes) in which the student has to demonstrate knowledge of the scientific background in the field of the presentation as well as command of methodology & technologies used in the field of developmental neuroscience. The grade assigned for this presentation and exam will account for 40% of the total grade of the module.  

**Literatur**  

- Gilbert, Developmental Biology (2013, 10th Ed)  
- Primary literature and academic reviews as provided by the instructors