

Titel des Moduls:	Genetics & Developmental Biology		
	Schwerpunktmodul I (M.Sc.)	SP1-02	
Modulverantwortlicher:	Fachbereich(e):		
Hess, Wolfgang	Genetics & Developmental Biology		
Typ:	Wahlpflichtmodul	Fachsemester:	2
Moduldauer:	1 Semester, Block	ECTS:	12
Turnus:	Sommersemester	Workload:	360 h
Empfohlene Voraussetzung:		Zwingende Voraussetzung:	OM-02
Verwendbarkeit:	M.Sc. Biology, Major Genetics & Developmental Biology		
Lehrende:	Baumeister, Ralf / Driever, Wolfgang / Hess, Wolfgang / Holzschuh, Jochen / Neubüser, Annette / Onichtchouk, Darja / Pichler, Andrea / Schulze, Ekkehard / Steglich, Claudia		

Veranstaltungstitel	Lehrform	ECTS	SWS	Workload [h]
Methods & Approaches in Current Genetics & Developmental Biology	Lecture	2	2	60 h
Molecular Genetics of RNA & Signalling Mechanisms	Practical exercise	7	5	210 h
Current Topics in Genetics & Developmental Biology	Seminar	3	2	90 h

Lernziele / Lernergebnisse	<p>The aim of this module is a molecular-level understanding and knowledge of experimental approaches of genetic and molecular mechanisms in cellular regulation and development.</p> <p>The students are able to</p> <ul style="list-style-type: none"> • describe basic research concepts using both single- and multi-cellular organisms. • describe principles of RNA-based regulation (riboregulation). • describe and draw the most important principles of signaling and development. • conduct state-of-the-art experiments for studying research problems of molecular genetics and developmental biology. • document and discuss results from own scientific experiments. • search scientific literature in databases and to present and discuss current research topics of molecular genetics and developmental biology.
Studienleistung	<ul style="list-style-type: none"> • Active participation in lectures, seminars and practical courses • Preparation of two course protocols • Preparation of a seminar presentation
Prüfungsleistung & Benotung	<ul style="list-style-type: none"> • Two short oral examinations ($\frac{1}{3}$) • Activity and one presentation within the two seminars ($\frac{1}{3}$) • Written protocols of lab exercises ($\frac{1}{3}$)
Literatur	<ul style="list-style-type: none"> • Watson: Molecular Biology of the Gene • Lewin: Genes • Alberts: Molecular Biology of the Cell • Gomberts: Signal Transduction (2nd Ed) • Specific scripts for the experimental work • Seminar: original publications are provided

Veranstaltungstitel:	Methods & Approaches in Current Genetics & Developmental Biology		
Lehrform:	Lecture		
Modul:	Schwerpunktmodul I „Genetics & Developmental Biology	SP1-02	
Verwendbarkeit:	Schwerpunktmodul I „Genetics & Developmental Biology		

Lehrsprache:	english	Teilnehmerzahl:	16
Moduldauer:	1 Semester, Block	Fachsemester:	2
Angebots-häufigkeit:	Nur im Sommersemester		

SWS / LVS	Präsenzstudium	Selbststudium	Workload Summe
2	30 h	30 h	60 h

Inhalte	<p>The lecture series covers general concepts of cellular and organismal control mechanisms in developmental genetics and the control of gene expression in pro- and eukaryotes at an advanced level including:</p> <ul style="list-style-type: none"> • The eukaryotic gene; Introns and spliceosomes • Non-spliceosomal introns and promiscuous introns • Catalytic RNA • Riboswitches • RNA Editing • Non-coding RNAs in Pro- and Eukaryotes • RNA-Interference and micro-RNAs • Cell cycle control • Cell differentiation in prokaryotes including spore formation, heterocyst differentiation and fruiting body development • Quorum sensing mechanisms in microbial populations • Fundamental mechanisms of development in eukaryotes • Epigenetics & the chromatin code • Sex determination and X-chromosome inactivation • Gene therapy • Signalling mechanisms: signal generation & modulation, receptors, signal transduction, kinase cascades, nuclear readouts, signal integration, gradients, quantitative aspects of signaling • Essential signaling cascades in higher eukaryotes: WNT, TGFbeta, FGF, Shh, Retinoic Acid, Delta/Notch - mechanisms and molecules • Signaling mechanisms in early vertebrate development • Cytoskeleton and cell behavior in morphogenesis • Methodological innovations: markers and reporter gene assay systems, fluorescence assays <i>in situ</i>...
Lehrmethoden und Medien	<p>Lectures Media: PowerPoint-Presentations, handouts, training sheets; blackboard; Materials are provided on ILIAS platform, diverse web-based resources and databases</p>

Lernziele / Lernergebnisse	<p>The students are able to</p> <ul style="list-style-type: none"> • apply the acquired knowledge on current research problems in the field of molecular genetics. • describe and draw the most important principles of signaling and development.
Studienleistung	Active participation in lectures
Prüfungsleistung & Benotung	Two short oral examinations make together 1/3 of the module grade
Literatur	<ul style="list-style-type: none"> • Watson: Molecular Biology of the Gene • Lewin: Genes • Alberts: Molecular Biology of the Cell • Gomberts: Signal Transduction (2nd Ed)

Veranstaltungstitel:	Molecular Genetics of RNA & Signalling Mechanisms		
Lehrform:	Practical exercise		
Modul:	Schwerpunktmodulmodul I „Genetics & Developmental Biology	SP1-02	
Verwendbarkeit:	Schwerpunktmodulmodul I „Genetics & Developmental Biology		

Lehrsprache:	deutsch / english	Teilnehmerzahl:	16
Moduldauer:	1 Semester, Block	Fachsemester:	2
Angebots-häufigkeit:	Nur im Sommersemester		

SWS / LVS	Präsenzstudium	Selbststudium	Workload Summe
5	75 h	135 h	210 h

Inhalte	<p>The exercises will enable the participants to design and perform complex experiments with a focus on molecular genetic methods to analyze RNA and how to approach the analysis of signaling mechanisms. They will learn a wide array of up-to-date technologies including:</p> <ul style="list-style-type: none"> • Isolation and manipulation of cellular RNA for molecular analysis • molecular biology • the application of reporter gene assays • signaling pathway manipulations • life cell imaging & analysis • <i>in situ</i> approaches • gain-of-function overexpression studies • embryo microinjections
Lehrmethoden	<p>The students will experimentally work in the laboratory on a current scientific objective in various topics of molecular genetics and developmental biology:</p> <ul style="list-style-type: none"> • RNA-based regulation of gene expression • Approaches to transcriptomic analysis • Signaling in pro- and eukaryotic organisms
Lernziele / Lernergebnisse	<p>The students are able to</p> <ul style="list-style-type: none"> • identify and describe state of the art research objectives in molecular genetics and developmental biology • plan, design, perform and document experiments on a current research topic in the field of molecular genetics and developmental biology • present, evaluate and discuss results from own experimental studies and integrate them into the state of the art of the research field

Studienleistung	<ul style="list-style-type: none"> • Active participation in experimental courses • Preparation of two course protocols
Prüfungsleistung & Benotung	Written scientific protocols of experimental work together make $\frac{1}{3}$ of the module grade
Literatur	<ul style="list-style-type: none"> • Specific scripts for the experimental work • Watson: Molecular Biology of the Gene • Lewin: Genes • Alberts: Molecular Biology of the Cell • Gomberts: Signal Transduction (2nd Ed) • Selected literature of the individual research topic (original articles, reviews)

Veranstaltungstitel:	Current Topics in Genetics & Developmental Biology	
Lehrform:	Seminar	
Modul:	Schwerpunktmodulmodul I „Genetics & Developmental Biology	SP1-02
Verwendbarkeit:	Schwerpunktmodulmodul I „Genetics & Developmental Biology	

Lehrsprache:	deutsch / english	Teilnehmerzahl:	16
Moduldauer:	1 Semester, Block	Fachsemester:	2
Angebots-häufigkeit:	Nur im Sommersemester		

SWS / LVS	Präsenzstudium	Selbststudium	Workload Summe
2	20 h	70 h	90 h

Inhalte	<p>The seminar will cover current topics in genetics or developmental biology with a focus on recent articles related to the practical approaches and techniques used in the two practical units within the module. Presentations by the students, one of two topics can be chosen either with a focus on molecular genetics or developmental biology. The students will present a seminar talk on a current scientific topic related to:</p> <ul style="list-style-type: none"> • Technical advances such as 3rd generation single-molecule based sequence analysis • Genomics and Epigenomics • Palaeogenomics and –genetics • Molecular mechanisms of cell differentiation in prokaryotes • Principles of RNA-based regulation of gene expression • Signalling cascades and their molecular design principles • Signalling mechanisms in development
Lehrmethoden	<p>Independent capturing of the content of the original literature; identification of weak or possibly critical points in the article; individual discussion of scientific content with the respective lecturer; Preparation of seminar presentation and of a hand-out; Presentation of the seminar (using power point or suitable open-source based software); Discussion of presentation content with all other participants of the seminar</p>
Lernziele / Lernergebnisse	<p>The students are able to</p> <ul style="list-style-type: none"> • present and discuss results from research topics related to that of the own experimental study, of the lecture content and others. • search literature in databases • plan and design a scientific talk in form of a power point presentation
Studienleistung	<ul style="list-style-type: none"> • Attendance of seminar talks • Active participation in seminars • Preparation of a seminar presentation and own seminar talk
Prüfungsleistung & Benotung	Activity within and presentation of the seminar make $\frac{1}{3}$ of the module grade
Literatur	Selected original research publications are provided