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Attachment 1
Module Descriptions

Module Number BT-RM B1	**Module Name** Stem Cells, Development and Regeneration	**Responsible Lecturer** Prof. Brand
Content and qualification aims	The students know the fundamental definitions and concepts of the major stem cell systems, the theoretical and practical aspects of somatic stem cell biology and the basic principles and molecular mechanisms that form the basis of the development of vertebrates, the organogenesis and the regeneration.	
Type of course	4 SWS lecture and 2 SWS seminar	
Requirements for participation	Basic knowledge of cell biology, molecular biology and developmental biology on Bachelor level Literature: • Alberts, Bruce: Molecular Biology of the Cell. Garland Science. Parts I+II • Gilbert, Scott: Developmental Biology. Sinauer Associates. Part I	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of a written exam (duration 180 minutes). Exam prerequisite is a presentation of 90 minutes.	
Credits and grades	In the module, 9 credit points can be acquired. The module grade is the examination grade.	
Frequency of the course	The module is offered every year in the winter semester.	
Workload	The workload is 270 hours.	
Duration of the module	1 semester	
Literature	• Wolpert et al.: Principles of Development. Oxford University Press • Gilbert, Scott: Developmental biology. Sinauer Associates. from Part II • Alberts, Bruce: Molecular Biology of the Cell. Garland Science. from Part III	

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Module Number BT-RM R1	**Module Name** Model Organism Research	**Responsible Lecturer** Prof. Calegari
Content and qualification aims	The modules comprises projects that offer the opportunity for students to set their own substantive focus in the area of regenerative biology. The students have extensive theoretical knowledge for working with one of most important model organisms. They are able to set up and carry out experiments, and thus test hypotheses in the area of regenerative therapies. They have extensive experience in the experimental work with model organisms. The students are able to reflect the practically gained knowledge and put it into scientific context.	
Type of course	2 SWS lecture, 2 SWS exercise, 20 SWS practical	
Requirements for participation	Basic knowledge of anatomy and biology on Bachelor level Literature: • Janssen & Smit (eds.): Emerging Model Organisms I. CSHL Press • Wolpert, Tickle et al.: Principles of Development. OUP	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of • an assigned paper (workload of 90 hours), • an oral examination (duration of 20 minutes) and • lab performance.	
Credits and grades	In the module, 16 credit points can be acquired. The module grade is the weighted average of the examination grades: • 1/3 assigned paper • 1/3 oral examination • 1/3 lab performance.	
Frequency of the course	The module is offered every semester.	
Workload	The workload is 480 hours.	
Duration of the module	1 semester	
Literature	• Nüsslein-Volhard et al.: Zebrafish: a practical approach. Oxford University Press • Hedrich et al.: The Laboratory Mouse (Handbook of Experimental Animals). Academic Press • Janssen & Smit: Emerging Model Organisms II. CSHL Press	

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Module Number BT-RM R2	**Module Name** Cell and Organ Based Research	**Responsible Lecturer** Prof. Ader
Content and qualification aims	The modules comprises projects that offer the opportunity for students to set their own substantive focus in the area of stem cells and organ systems. The students have extensive theoretical knowledge in working with cell systems, e.g. embryonic stem cells, somatic stem cells and organ systems such as hematopoietic cells, pancreas, central nervous system and heart. They are able to set up and carry out experiments, and hence test hypotheses in the area of cell-based regeneration strategies. Additionally, they have extensive practical experience in the experimental work in cell and organ research. The students are able to reflect the practically gained knowledge and put it into scientific context.	
Type of course	2 SWS lecture, 2 SWS exercise, 20 SWS practical	
Requirements for participation	Basic knowledge of stem cell biology, biochemistry, physics, concepts of cell- and molecular biology on Bachelor level. Literature: • Alberts, Bruce: Molecular Biology of the Cell. Garland Science. Part I+II • Campbell, N., Reece, J.: Biology. Pearson Education	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of • an assigned paper (workload of 90 hours), • an oral examination (duration of 20 minutes) and • lab performance.	
Credits and grades	In the module, 16 credit points can be acquired. The module grade is the weighted average of the examination grades: • 1/3 assigned paper • 1/3 oral examination • 1/3 lab performance.	
Frequency of the course	The module is offered every semester.	
Workload	The workload is 480 hours.	
Duration of the module	1 semester	

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Module Number BT-RM R3	**Module Name** Molecular Biology Research	**Responsible Lecturer** Prof. Kempermann
Content and qualification aims	The modules comprises projects that offer the opportunity for students to set their own substantive focus in the area of molecular biology. The students have extensive theoretical knowledge in stem and tissue cells including current knowledge of molecular biological techniques. They are able to set up and carry out experiments to generate reagents and to analyze stem cells and tissue, and hence to test hypotheses in the area of molecular biology. They have extensive practical experience in the experimental work in molecular biology. The students are able to reflect the practically gained knowledge and put it into scientific context.	
Type of course	2 SWS lecture, 2 SWS exercise, 20 SWS practical	
Requirements for participation	Basic knowledge of molecular biology on Bachelor level Literature: • Alberts, B.: Molecular Biology of the Cell. Garland Science. Part I+II • Griffiths, A.: Introduction to Genetic Analysis. Freeman Press	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of • an assigned paper (workload of 90 hours), • an oral examination (duration of 20 minutes) and • lab performance.	
Credits and grades	In the module, 16 credit points can be acquired. The module grade is the weighted average of the examination grades: • 1/3 assigned paper • 1/3 oral examination • 1/3 lab performance.	
Frequency of the course	The module is offered every semester.	
Workload	The workload is 480 hours.	
Duration of the module	1 semester	

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Module Number BT-RM P1	**Module Name** Light and Electron Microscopy	**Responsible Lecturer** Prof. Brand
Content and qualification aims	The students have an overview on basic and high-end microscopy and know the fundamentals of geometrical optics, wave optics, fluorescence microscopy, digital image recording, electron optics, electron microscopy in the life sciences, the preparation of biological samples for transmission electron microscopy (TEM) and scanning electron microscopy (SEM), the production of semi-thin and ultra-thin sections, immuno-gold markers and microscopy (TEM/SEM). They know the fundamental principles in light and electron microscopy and are able to examine biological samples using different photo-optical methods (transmitted light, fluorescence, confocal microscopy) as well as TEM and SEM. Additionally, they know basic methods for sample preparation for the analysis with light and electron microscopy.	
Type of course	Lecture, exercise and practical are offered as block seminar with a duration of two weeks (1/3 lecture, 1/3 exercise, 1/3 practical).	
Requirements for participation	Basic knowledge in optics, cell biology and histology, especially of model organisms, and electron optics and/or fluorescence microscopy on Bachelor level Literature: • Murphy, D.: Fundamentals of Light Microscopy and Electronic Imaging. Wiley-Blackwell • Goodhew, P.: Electron microscopy and analysis. CRC Press	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of • a written exam (duration 30 minutes) and • a protocol.	
Credits and grades	In the module, 5 credit points can be acquired. The module grade is the unweighted average of the examination grades.	
Frequency of the course	The module is offered every year in the winter semester.	
Workload	The workload is 150 hours.	
Duration of the module	1 semester	
Literature	Bozzola JJ, Russel LD: Electron Microscopy, 2nd edition. Jones and Bartlett	

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Module Number BT-RM B2	**Module Name** Genetic and Quantitative Analysis of Stem Cell Biology	**Responsible Lecturer** Prof. Kempermann
Content and qualification aims	The students know genetic techniques and computer-aided methods for stem cell investigation. They understand the classic genetic approach of stem cell biology in model organisms as well as the genetic regulatory mechanisms that define the key moments such as the transition between proliferation and differentiation. They know functional methods to identify relevant genes for stem cell fate. They know strategies to manipulate stem cells on molecular level and the principles of systems biology in comparison to conventional strategies. They also know analysis methods for quantitative biological data that are suitable for analyzing small and large experimental data sets from molecular biology and genetics. The students are able to do statistical analyses of experimental data, to analyze large biological data sets (e.g. genome-wide measuring and sequencing data), and to understand data integration and modelling techniques for the analysis of biological processes on system levels.	
Type of course	2 SWS lecture and 2 SWS exercise	
Requirements for participation	Basic knowledge in cell biology and human biology on Bachelor level Literature: Griffiths, A.: Introduction to Genetic Analysis. Freeman Press. Pt. I	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of a • written exam (duration 90 minutes) and • a protocol.	
Credits and grades	In the module, 8 credit points can be acquired. The module grade is the weighted average of the examination grades: • 2/3 written exam • 1/3 protocol	
Frequency of the course	The module is offered every year in the summer semester.	
Workload	The workload is 240 hours.	
Duration of the module	1 semester	
Literature	• Griffiths, A.: Introduction to Genetic Analysis. Freeman. From Part II • Crawley, Michael J.: Statistics: An Introduction using R. Wiley	

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Module Number BT-RM P2	**Module Name** Scientific Working Methods and Conduct	**Responsible Lecturer** Prof. Bonifacio
Content and qualification aims	The students know methods of scientific working as well as appropriate vs. inappropriate conduct in scientific research and potential conflicts. They are able to prepare and give a scientific talk, to find, read and analyze a scientific publication and to present it. They know the set-up of a lab project and are able to identify fundable research projects. Additionally, they are able to develop strategies for preparing and implementing successful research proposals and know the importance of intellectual property rights. They can define what can/should be patented and know correct ethical conduct in scientific studies. They are able to react appropriately if fraud or other unethical conduct is discovered.	
Type of course	3 SWS seminar, 1 SWS practical	
Requirements for participation	Basic knowledge of scientific work, in cell, molecular and developmental biology on Bachelor level Literature: Zeiger, M.: Essentials of Writing Biomedical Research Papers. McGraw-Hill	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of • a paper (scope of 40 hrs.) and • a presentation.	
Credits and grades	In the module, 5 credit points can be acquired. The module grade is the unweighted average of the examination grades.	
Frequency of the course	The module is offered every year, starting in the winter semester.	
Workload	The workload is 150 hours.	
Duration of the module	2 semesters	

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Module Number BT-RM P3	**Module Name** Clinical Translation and Trials in Practice	**Responsible Lecturer** Prof. Bornhäuser
Content and qualification aims	The students know the basic regulations for clinical research with humans in the EU and Germany and have an overview of the German Drug Law and good clinical practice (GCP), the international quality standard for clinical studies. They have knowledge of EU regulations for advanced cellular therapies and local regulations for cell-based therapies, specifications of good manufacturing practice (GMP) as well as the genetic manipulation of cells in clinical studies. The students know the basics of planning and conducting the phase I-III studies based on an experimental therapy and have an overview of the necessary infrastructure, preclinical data and bioinformatics methods that are need to planning a researcher-initiated study. Additionally, they know the Helsinki declaration and fundamentals of patients' rights. They are familiar with the necessary documentation for clinical protocols such as the investigator's brochure, the patients' education and the declaration of consent. The students have basic knowledge of regulatory requirements and preclinical studies including toxicological tests, metabolism and pharmacology that need to be fulfilled before a clinical study can be begun. They are also familiar with the tasks and obligations of a sponsor and a researcher according to the provisions of GCP.	
Type of course	2 SWS lecture and 2 SWS exercise	
Requirements for participation	Basic knowledge in pathophysiology and human disease syndromes as well as in biometrical analysis and statistics on Bachelor level or preliminary examination level (medicine). Literature: • Pocock, S.: Clinical Trials - A practical approach. Wiley & Sons • Friedman et al. (eds.): Fundamentals of Clinical Trials. Springer. Chapter 1.	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of a written exam (duration of 90 minutes).	
Credits and grades	In the module, 5 credit points can be acquired. The module grade is the exam grade.	
Frequency of the course	The module is offered every year in the winter semester.	
Workload	The workload is 150 hours.	
Duration of the module	1 semester	

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Literature	• Friedman et al. (eds.): Fundamentals of Clinical Trials. Springer. From chapter 2. • Schwarz, J.: Leitfaden Klinische Prüfungen von Arzneimitteln und Medizinprodukten. Edition Cantor Verlag • Eberhardt, R., Herrlinger, C.: Monitoring und Management Klinischer Studien. Edition Cantor Verlag

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Module Number BT-RM B3	**Module Name** Organ Systems and Disease	**Responsible Lecturer** Prof. Bonifacio
	The students understand structure and function of affected organ systems including their development, morphology and physiology. They know the pathophysiology of diseases, clinical manifestations and current standards in care, and are familiar with current problems and concepts of regenerative approaches, translational aspects as well as strategies and instruments of regenerative medicine. They have basic theoretical knowledge of pathophysiology of diseases and extended knowledge on the use of cell and tissue regeneration for correcting these pathologies. They know the current scientific research status in the area of bioengineering and are able to prepare simple matrices for tissue replacement. The students are familiar with basic principles in designing artificial structures for specific clinical applications. They know the principles of tissue engineering and understand the basic principles necessary for adjusting the chemical and physical characteristics of biomaterials for the demands of medical application.	
Content	The module comprises clinical concepts of diseases that have a therapeutic use for regenerative biology, especially in the fields of brain and bone marrow diseases, retina degeneration, diabetes, cardiovascular diseases, hematopoiesis, angiology, bone and cartilage tissue engineering. Additionally, the module comprises basics of tissue engineering and the challenges that accompany the imitation of natural tissue context as well as instruments and techniques from biology, chemistry and physics that are necessary to control tissue engineering in vitro.	
Type of course	8 SWS lecture + 2 SWS seminar	
Requirements for participation	Basic knowledge of stem cell biology, biochemistry and physics on Bachelor level Literature: • Hoffmann, R. et alt.: Hematology - Basic Principles and Practice. Elsevier • Calegari, F.: Stem Cells: From Basic Research to Therapy. CRC Press • Lanza, R. et al. (eds.): Principles of Tissue Engineering. Elsevier Academic Press. Introduction	
Usability of the module	The module is a compulsory module in the Master's course of study Regenerative Biology and Medicine.	
Requirements for the award of credits	Credit points are awarded if the module examination is successfully passed. The module examination consists of a two written exams (duration of 90 minutes each).	

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Credits and grades	In the module, 10 credit points can be acquired. The module grade is the unweighted average of the examination grades.
Frequency of the course	The module is offered every year, starting in the summer semester.
Workload	The workload is 300 hours.
Duration of the module	2 semesters
Literature	• Bunting (ed.): Hematopoeietic Stem Cell Protocols. Humana Press • Kondo, Motonari (ed.): Hematopoeietic Stem Cell Biology. Humana Press • Murphy, K.: Janeway's Immunobiology. Garland Publishing Inc. • Lanza, R. et al. (eds.): Principles of Tissue Engineering. Elsevier Academic Press. ab Part I • Pallua, N. (ed.): Tissue Engineering: From Lab to Clinic. Springer