

Master Programme

Physical Biology of Cells and Cell Interactions

(PBioC)

Description of modules for the Master's course

According to the study regulations from 2015

Status: September 2022

The English version is for general information only and not legally relevant.

Overview of Modules:

Compulsory Modules (PM)

- 1 Introduction to the Master Program and Basic Methods in Cell Biology
- 2 Advanced Cell Biology I
- 3 Advanced Cell Biology II
- 4 Current Concepts in Cell Biology
- 5 Advanced Methods in Cell Biology
- 6 Master Thesis

Export Module (EM)

- 7 Module for students from other Masters

Module „Free Studies“

- 8 Module “Free Studies” for Students of the Master PBioC

Elective Modules (Wahlpflicht; WP)

	Module name	Responsible
9	External Practical Module Cell Biology	Head of The Master Degree Program
10	Cell Biology and Physiology of Signal Transfer This module will be terminated in WS 2016/17	Prof. Dr. W. Volkhardt
11	How to make a Neuron: From Stem Cells to Stable Cell Lines. This module will be terminated in SS 2017	* Dr. K. Gampe
12	Neurophysiology of Sensory Systems	Prof. Dr. M. Kössl
13	Auditory Function and Dysfunction: Behaviour and Physiology	PD Dr. B. Gaese
14	Information Processing in the Central Auditory System	PD Dr. B. Gaese
15	Developmental Neurobiology This module will be terminated in WS 2016/2017	Prof. Dr. A. Acker-Palmer
16	Physiology and Behaviour	Prof. Dr. M. Grünewald
17	Three-Dimensional Cell Cultures and Three-Dimensional Microscopy	Prof. Dr. E.H.K. Stelzer
18	Three-Dimensional Developmental Biology and Three-Dimensional Microscopy	Prof. Dr. E.H.K. Stelzer
19	Three-Dimensional Plant Cell Biology and Three-Dimensional Microscopy This module will be terminated in SS 2018	Prof. Dr. E.H.K. Stelzer

20	Cell Communication, Cell Adhesion and Cell Motility	Prof. Dr. A. Starzinski-Powitz
	<i>This module will be terminated in WS 2017/18</i>	
21	Plant Cell Biology	Prof. Dr. E. Schleiff
22	Fungal Cell Biology	Prof. Dr. H. Osiewacz
	<i>This module will be terminated in WS 2021/22</i>	
23	Function and Evolution of Metabolic Pathways	Prof. Dr. I. Ebersberger
24	Special Aspects of Immunology	* Prof. Dr. Z. Waibler
25	Developmental Genetics	Prof. Dr. D. Stainier
26	Cell Biology and Gene Expression Control	* PD-Dr. J. Lausen
27	Endothelial Cells and Tumour Cell Biology	* Dr. B. Strilic
28	Principles of Tube Morphogenesis	* Dr. M. Nakayama
29	Developmental Cell Biology	Prof. Dr. V. Lecaudey
30	Basics and Appliance of Image and Data Analysis in Biology	** Dr. S. Fischer
	<i>This module will be terminated in SS 2018</i>	
31	Biology of Extracellular Vesicles	* Dr. S. Momma
32	Special Aspects of Tumour Biology	*** Prof. Dr. K. Strebhardt
33	Cellular RNA Biology	Prof. Dr. M. Müller-McNicoll
34	Neuronal basis of acoustic communication in mammals	**** Dr. J. Hechavarria
35	Cellular, molecular and systemic Neurobiology in mouse and zebrafish	***** Prof. Dr. A. Acker-Palmer, Dr. B. Kirchmaier
36	Basics of quantitative developmental biology— Analysis of dynamic processes	* Dr. C. Pohl
37	Data analysis, mathematical modelling and simulation	Prof. Dr. F. Matthäus
38	Understanding the molecular mechanisms leading to Parkinson's disease	Prof. Dr. S. Eimer
39	Cellular and molecular mechanisms in neurodegenerative disorders	Prof. Dr. J. Hefendehl
40	Molecular Psychiatry	* Dr. F. Freudenberg
41	Cardiovascular Development	* Dr. P. Grote
42	Studying the molecular genetics of neuropsychiatry	Prof. Dr. Chiocchetti

Note:

* This module will take place under responsibility of the academic director of the Master course.

- ** This module will take place under responsibility of Prof. Dr. E.H.K. Stelzer.
- *** This module will take place under responsibility of Prof. Dr. K. Strebhardt and the academic director of the Master course.
- **** This module will take place under responsibility of Prof. Dr. M. Kössl.
- ***** This module will take place under responsibility of Prof. Dr. A. Acker-Palmer.

MSc PBioC: 1	Introduction into the Master Program and Basic Methods in Cell Biology	Compulsory Module	14 CP (sum) = 420 h		14 SWH
			Contact-studies 14 SWH / 210 h	Self-studies 210 h	
Contents					
<p>The module focuses on 3 main areas:</p> <p>1. <u>Introduction to the Master's program</u>: In a two-day seminar there will be an introduction to the Master program. Here, the students are introduced to the qualification goals and research focuses of the degree program as well as the cell biological and physical fields of work, research groups and research projects, modules and module supervisors or their deputies of the Master's program. Students will have the opportunity to exchange information with the third semester students about the course and its contents.</p> <p>2. <u>Basic Methods in Cell Biology</u>: Another focus is an 8-week practical course on common molecular biological, protein biochemical, immunological, histological, cell biological, microscopic working methods and techniques as well as an introduction to bioinformatics. In groups, the participants elaborate the theoretical background of the different working methods and carry them out after briefing under scientific guidance and support. Students get to know different bioinformatics databases and their application. Students will learn methods and algorithms for the bioinformatics analysis of large sequence data sets.</p> <p>The students gain an insight into different experimental scientific working techniques, their theoretical basics and their evaluation. They will present and discuss their experimental results in a seminar. After completion of this module, the students will have learned a spectrum of methodological basics, which they can apply in the individual elective modules.</p> <p>3. <u>Legal and ethical aspects of life sciences</u>: The topics are taught in full-day lectures and seminars: Animal Protection Act, Bio- and Science Ethics, Contents of the Embryo Protection Act, Gene Technology Act, Biological Safety, Biological Substances Ordinance, Infection Protection Act, Occupational Safety and Health, the Rules of Good Scientific Practice as well as the Fundamentals of Patent Law are taught. The students are taught the following theoretical basics on 3 days, all day, regarding the aspect of animal protection law: Introduction to laboratory animal science, legal basics, ethical aspects of animal experiments, mouse, rat, rabbit: Anatomy, physiology, behaviour and feeding, general application and blood collection techniques, as well as rat, mouse and gerbil, breeding and genetics of laboratory rodents, basics of surgical work, basics of anaesthesia and pain control in laboratory animals, pain, suffering, damage and anxiety in laboratory animals, basics of killing in accordance with animal welfare, basics for statistical experiment planning, animal husbandry, health monitoring in laboratory animal populations, hygiene in animal husbandry, writing an application for an animal experiment.</p> <p>The theoretical and technical contents of this module are taught according to the legal requirements of animal protection. Participation is compulsory for all students of the Master's program and must be confirmed in writing. The module part is completed according to the legal requirements of animal protection.</p> <p>According to the Genetic Engineering Act, it is mandatory for students to take part in a S1 safety instruction. Students will be informed about the contents of the operating instructions for genetic engineering according to § 12 Abs. 2 GenTSV. This contains, among other things: Safety regulations in the laboratory, protective measures and rules of conduct, important aspects of occupational safety, completion of genetic engineering documents, obligation to keep records, conduct in the event of incidents in the laboratory.</p> <p>Students are introduced to the following topics on the subject of biological safety and the Ordinance on Biological Substances: Ordinance on safety and health protection in activities involving biological agents, what are biological agents, classification into risk groups, distinction between targeted and non-target activities, hazard assessment, duty to report and record, operating instructions, protective and hygiene measures, information for employees.</p> <p>Lectures and seminars on the topics: Legal and ethical aspects of the courses are mandatory for the students and must be confirmed by proof of attendance.</p>					
Educational Objectives / Competences					
<p>Within this introductory module, students learn to deal intensively and independently with the theoretical and practical contents of their studies and to plan the course of their studies. They learn to find their way in a scientific-English-speaking environment; to plan and carry out scientific experiments independently; and to critically evaluate, present and discuss experimental approaches and solutions according to the rules of Good Scientific Practice. After completing the internship, the student should be able to know basic molecular biological, protein-biochemical, immunological, cell biological and microscopic working methods common in research and to carry them out independently with the help of work instructions. The students know how to use selected databases of bioinformatics and how to apply them. They acquire the competence to select and apply suitable methods for defined scientific questions and to evaluate them critically. When working with genetically modified organisms and handling biological agents, students acquire the competence to comply with the guidelines of the operating instructions for genetic engineering work and the Ordinance on Biological Substances.</p> <p>They gain the competence that animal experiments can only be planned and carried out under bioethical and scientific aspects, taking into account and complying with the contents of the Animal Protection Act.</p> <p>After completion of the module, students will become familiar with the topics: Animal Protection Act, Bio- and Science Ethics, Contents of the Embryo Protection Act, Genetic Engineering Act, Biosafety, Bio substances Ordinance, Infection Protection Act, Occupational Safety and Health, the Rules of Good Scientific Practice and the Basics of Patent Law.</p>					
Requirements for Participation					

None									
The module starts in the first part of winter term and is compulsory.									
Recommended Requirements									
Admission or preliminary admission to the Master program, knowledge of English.									
Module Assignment (Studiengang / Fachbereich)	Master PBioC - FB 15								
Applicability to other Course of Study	The module parts legal and ethical aspects in biosciences, animal welfare act, patent law, biosafety and biological agent law, rules of good scientific practice and embryo protection law can be taken from Master programs of the FB 15 as well as the Master in Interdisciplinary Neuroscience.								
Dates and Module Frequency	Annually in the first part of winter term								
Duration	8 weeks (3-4 days / week, full-time)								
Module Responsible	Head of examination board								
Proof of Study									
Proof of Participation	1. Proof of participation: Introduction into the Master's program. 2. Proof of participation in lectures and seminars to the aspects: animal welfare law, the German embryo protection law, gene technology law, biological safety, rules of good scientific practice, basics in patent law 3. Proof of participation in safety and operating instructions for S1 laboratories, gene technology safety regulation (GenTSV), (§12Abs.2GenTSV), bio-substances regulation (BioStoffV)								
Course Assessment	Seminar talk of about 20 - 40min Lab book (10-15 pages)								
Forms of Teaching	Practical course, lecture, seminar, practice								
Language	English								
Module Completion Test	Form / duration / content (if applicable)								
Module Completion Test consists of:	Examination (90 min)								
	Teaching forms	SWH	CP	Semester					
				1	2	3	4	5	6
Lecture	[V]	2	2	X					
Seminar	[S]	1	1	X					
Practical	[P]	11	11	X					
Module Completion Test									
Sum		14	14						

MSc PBioC: 2	Advanced Cell Biology I	Compulsory Module	6 CP (sum) = 180 h		6 SWH					
			Contact - studies 6 SWH / 90 h	Self- studies 90 h						
Contents										
<p>Lecture series: Selected topics on physical biology of cells and cell interactions, cell biology, physiology, neurophysiology, cell types and their functions, developmental as well as molecular and biochemical principles of the function of various animal and plant cells, mechanisms of signal transmission and development of nerve cells and nerve systems.</p> <p>Seminars are based on the lectures on selected topics of physical biology of cells and cell biology. The students present relevant original publications.</p> <p>Colloquia: Students participate in 4 cell biology / physical biology oriented colloquia at the institute.</p>										
Educational Objectives / Competences										
<p>Students develop a broad interdisciplinary basic knowledge in the fields of cell biology, as well as its application possibilities. Students learn scientific research concepts, are able to link different fields and paradigms in cell biology with another. The student lectures on his/her results in a seminar and is, in this context, competent to process information from original publications.</p>										
Requirements for Participation										
None										
Recommended Requirements										
Basic knowledge in cell biology and physical biology										
Module Assignment (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other Course of Study			FB 15 Master's courses							
Dates and Module Frequency			Annually, first and second part of winter term							
Duration			2 days per week (90 min lecture and seminar)							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			Participation in seminars and colloquia							
Course Assessment			20-30 min presentation in the seminar							
Forms of Teaching			lecture, seminar, colloquia, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Examination (90 min), Content: Topics of the lecture and the seminar							
Advanced Cell Biology I		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
Lectures		[V]	4	3	X					
Seminar		[S]	1.5	2	X					
Colloquia		[Ko]	0.5	1	X					
Module Completion Test					X					
Sum			6	6						

MSc PBioC: 3	Advanced Cell Biology II	Compulsory Module	7 CP (sum) = 220 h		7 SW H					
			Contact-studies 7 SWH / 110 h	Self-studies 110 h						
Contents:										
<p>Lecture series: Selected topics of cell biology of higher eukaryotes. Contents: Cellular, molecular, physiological, structural and physical principles of development and function of higher eukaryote cells including plants; mechanisms of cell-cell and cell-matrix detection, receptor systems and their ligands, signal transmission, apoptosis, vesicular transport of cells, stem cell concepts and cellular plasticity, tumour biology and plant cell biology. Seminar on the lectures: Selected topics of higher eukaryote cell biology. The students present relevant original publications.</p> <p>Lecture and seminar: Molecular principles of vertebrate genetics Contents: Specific and current concepts of genetic analysis of eukaryotic genes and their products will be discussed here; targeted suppression of genes by homological recombination; functional suppression of genes, phenotype analyses. The students present relevant original publications.</p> <p>Colloquia: Students participate in 4 cell biology / physical biology oriented colloquia at the institute.</p>										
Educational Objectives / Competences										
After completing the module, the students are familiar with the principles in cell biology and their uses. They learn cell biology research concepts on various model organisms and are able to link different subareas and paradigms of cell biology. They will have learned to present and discuss original publications in the form of a lecture.										
Requirements for Participation										
none										
Recommended Requirements										
Basic knowledge in cell biology										
Module Assignment (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other Course of Study			FB 15 Master's courses							
Dates and Module Frequency			First and second part of summer term							
Duration			2 days per week (90 min lecture and seminar)							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			Participation in seminars and colloquia							
Course Assessment			20-30 min presentation in the seminar							
Forms of Teaching			lecture, seminar, colloquia, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Examination (90 min), Content: Topics of the lecture and the seminars: selected topics on higher eukaryote cell biology and molecular principles of vertebrate genetics.							
Advanced Cell Biology II		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
Lectures		[V]	4	4		X				
Seminar		[S]	2.5	2		X				
Colloquia		[Ko]	0.5	1		X				
Module Completion Test										
Sum			7	7						

MSc PBioC: 4	Current Concepts in Cell Biology	Compulsory Module	15 CP (sum) = 450 h		12 SWH					
			Contact-studies 12 SWH / 180 h	Self-studies 270 h						
Contents										
The module includes a project and a seminar with the aim of teaching students the major theoretical principles of research concept development in cell biology. After familiarisation with the current literature, critical open questions are to be identified and research strategies for solving them are developed. The research concept is to be drafted in the form of an application for third-party subsidy.										
Educational Objectives / Competences										
After completing this module, students are familiar with the development of scientific research concepts and integrating them into third-party funding applications. The students can assess the relevance of different and conflicting theories and research concepts and transfer them into new contexts.										
Requirements for Participation										
Passing the following modules: Introduction into the Master's Program and Basic Methods in Cell Biology (module 1), Advanced Cell Biology I (module 2), Advanced Cell Biology II (module 3) and 2 of the 3 elective modules. Note: This project work can be done in any cell biology working group in the Master's course of the faculty of biosciences, FB 15, Goethe University and is not necessarily linked with the Master thesis.										
Recommended Requirements										
None										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses							
Dates and Module Frequency			at any time							
Duration			4-5 weeks, full-time							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			none							
Course Assessment			Presentation of the research concept (20-30 min) in a seminar							
Forms of Learning			Project, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Written research concept of 5-20 pages							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Project work	[Pr]	11	14			X	X	
		Seminar	[S]	1	1			X	X	
		Module Completion Test								
		Sum		12	15					

MSc PBioC: 5	Advanced Methods in Cell Biology	Compulsory Module	15 CP (sum) = 450 h					15 SWH		
			Contact studies 15 SWH / 225 h		Self-studies 225 h					
Contents										
The module consists of an internship and a seminar. The aim is to provide students the essential experimental techniques of the specific field of study intended for the Master thesis. This should be done in a way that the Master thesis can be successfully completed within the available time frame.										
Educational Objectives / Competences										
After completing the module, the students will be familiar with the practical principles related to their Master thesis. The students will be able to efficiently dissect methodical information from publications and the world wide web, to assess the feasibility of methodical approaches and to be able to critically evaluate methods and artefacts.										
Requirements for Participation										
Passing the following modules: Introduction into the Master's Programme and Basic Methods in Cell Biology (module 1), Advanced Cell Biology I (module 2), Advanced Cell Biology II (module 3), Current Concepts in Cell Biology (module 4) and the 3 elective modules.										
Recommended Requirements										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses						
Dates and Module Frequency				Throughout the year; from the third semester on						
Duration				5-6 weeks						
Module Responsible				Head of examination board						
Proof of Study										
Proof of Participation				none						
Course Assessment				Presentation of 20-30 minutes, progress report in the working group						
Forms of Learning				practical course, seminar, self-studies						
Language				English						
Module Completion Test				Form / duration / content (if applicable)						
Module Completion Test consists of				Oral examination of 30 min						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	14	14			X	X		
	Seminar	[S]	1	1			X	X		
	Module completion test: Oral examination									
	Sum		15	15						

MSc PBioC: 6	Master Thesis	Compulsory Module	30 CP (sum.) = 900 h		30 SWH					
			Contact studies 30 SWH / 450 h	Self-studies 450 h						
Contents										
In their Master thesis, students work on a scientific research question within six months and deepen their knowledge of scientific research methods. This may involve experimental, empirical or analytical work. The results must be summarised in a written Master thesis in the style of scientific publications. The supervisor and a second reviewer evaluate the quality of the performance.										
Educational Objectives / Competences										
After completing the module, the student is able to deal with scientific questions and problems and to embed the findings gained in the existing literature. The student learns to write papers in a scholarly publication style and to apply and assess modern research methods.										
Requirements for Participation										
Proof of having gained at least 90 CPs and having passed the module Advanced Methods in Cell Biology (module 5). The Master thesis is usually mentored by a university teacher, provided that he or she regularly hosts compulsory or elective modules in the Master's programme.										
Recommended Requirements										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study										
Dates and Module Frequency			The dates and frequency are pending							
Duration			6 months							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			none							
Course Assessment			30 min presentation of the Master thesis in a seminar in the working group							
Forms of Learning			seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Written thesis (the mark will be double weighted compared to that/those gained in all other modules).							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Seminar Presentation	[S]	30				X		
		Module Completion Test: Master Thesis	[MA]					X		
		Sum		30						

MSc PBioC: 7	Module for Students from other Masters	Export Module	15 CP = 450 h		15 SWH					
			Contact-studies 15 SWH / 225 h	Self-studies 225 h						
Contents										
<p>The module is an export module and includes an elective module (Appendix 4) and completion of a project on current concepts in the specific subject module chosen. This is intended to ensure applicability to other FB 15 master's degree courses of study.</p> <p>This module specifies the performance required of students from other master's degree courses. Students must elaborate controversial key questions in the subject chosen using important original works and overview articles. Project work is to be written in the form of an overview or summary article the scope of which is agreed beforehand with the academic responsible for the module.</p>										
Educational Objectives / Competences										
Students will be familiarized with the theory and practice relevant to the specific module subject chosen and be able to prioritize current developments and controversies in the same field after completing the module.										
Recommended Requirements										
none										
Special note:										
This module only applies to students of other master's degree courses needing a module lasting half a semester for which 15 CPs are awarded.										
Module Assignmet (Studiengang / Fachbereich)			Master Course of FB 15							
Applicability to other course of study			FB 15 master's degree courses as well as Master in Interdisciplinary Neuroscience.							
Dates and Module Frequency			Annually in winter and summer term.							
Duration			15 SWH							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			none							
Course Assessment			Written project work							
Forms of Learning			practical course, seminar, self-studies							
Language			English							
Module completion test			Form / duration / content (if applicable)							
Module completion test			As indicated in the module description							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Practical	[P]	11	11	X	X			
		Project work	[Pr]	4	4	X	X			
		Module completion test: Protocol, Examination, Written Elaboration								
		Sum		15	15					

MSc PBioC: 8	Module “Free Studies” for students from the Master PBioC	Import Module	11 CP = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
The students get the possibility to choose an elective module from the Master courses of other faculties of the Goethe University.										
Educational Objectives / Competences										
After completing the module, the student will be familiar with the theory and practice of the chosen subject and will be able to assess the current developments and controversies in the subject area.										
Recommended Requirements										
None										
Special note:										
This module can replace an elective module in Appendix 4. It requires the prior approval of the examination board or the academic head of the Master’s programme.										
Module Assignmet (Studiengang / Fachbereich)			Master Course of FB 15							
Applicability to other course of study										
Dates and Module Frequency			Annually in winter and summer term.							
Duration			11 SWH							
Module Responsible			Head of examination board							
Proof of Study										
Proof of Participation			none							
Course Assessment			The regulations of the provider of the module apply							
Forms of Learning			practical course, seminar, self-studies							
Language			English							
Module completion test			Form / duration / content (if applicable)							
Module completion test			The regulations of the provider of the module apply							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Practical	[P]	10	10	X	X			
		Seminar	[S]	1	1	X	X			
		Module completion test: Protocol, Examination, Written Elaboration								
		Sum		11	11					

MSc PBioC: 9	External Practical Module Cell Biology	Elective Module	11 CP = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
The obligatory choice practical teaches the basic methods and techniques in basic cell biological and physical biology science. Students work on some current projects under supervision and present the results in the form of a seminar lecture. They learn how to draft scientific papers by writing a protocol of their results. The module can be offered by the faculties of the Goethe University, of other universities in Germany and elsewhere and by research facilities that are not part of any university.										
Educational Objectives / Competences										
Knowledge of how to perform cell biological or physiological experiments in the basic sciences field. Working out scientific problems against the background of relevant literature.										
Recommended Requirements										
none										
Special note										
Lectures and protocol in English. The module is an external one that can replace an elective module in Appendix 4, especially if performed during an ERASMUS study semester abroad. It requires the agreement of the examination board or the head of the Master's programme. It is co-supervised by a university teacher, who is involved in the Master's programme. The form of test performance required will be advised at the beginning of the respective semester. Aside from ERASMUS studies, there is no claim to perform the External Practical Module Cell Biology as long as practical courses from the Master Physical Biology of Cells and Cell Interactions can be offered.										
Module Assignmet (Studiengang / Fachbereich)			Master Course of FB 15							
Applicability to other course of study										
Dates and Module Frequency			Annually in winter and summer term							
Duration			4-5 weeks, full-time							
Module Responsible			Head of examination board							
Proof of Study			The regulations of the provider apply. If a proof of study is not provided, an internship protocol (10 – 20 pages) must be written as well as a presentation in a seminar on the results has to be given (20 – 30 min).							
Proof of Participation			none							
Course Assessment			Protocol, seminar talk on the results of own scientific studies and on the current literature							
Forms of Learning			practical course, seminar, self-studies							
Language			English							
Module completion test			Form / duration / content (if applicable)							
Module completion test			Protocol, poster or examination. The regulations of the provider apply. If a grading is not provided by the provider of this module, the protocol will be graded.							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Practical	[P]	10	10	X	X			
		Seminar	[S]	1	1	X	X			
		Module completion test: Protocol								
		Sum		11	11					

MSc PBioC: 10	Cell Biology and Physiology of Signal Transfer	Elective Module	11 CP = 330 h		11 SWH
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents					
This module is terminated in winter term 2016/17!					

MSc PBioC: 11	How to make a Neuron: From Stem Cells to Stable Cell Lines.	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact studies 11 SWH / 165 h	Self-studies 165 h	
Contents					
This module is terminated in summer term 2017!					

MSc PBioC: 12	Neurophysiology of Sensory Systems	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact studies 11 SWH / 165 h	Self-studies 165 h	
Contents					
This module is terminated in winter 2022/23!					

MSc PBioC: 13	Auditory Function and Dysfunction: Behaviour and Physiology	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
The practical teaches techniques to determine auditory function and dysfunction in rodents. These techniques can be used to determine effects of pharmacological or behavioural treatments of sensory disorders such as tinnitus or hearing loss. The focus is on behavioural techniques suitable to characterize the disorder rather precisely in comparison to normal functions. All steps that are necessary for a project in the field are taught in this practical: study design, animal handling, control of experimental parameters, pharmacological treatment of animals, and data analysis. The behavioural analysis is paralleled by basic electrophysiological measurements necessary to determine the effects of dysfunction and treatments at the physiological level. The students work on their own projects under supervision and present their results in the form of a seminar talk. The main focuses are: measuring and analysing behavioural data, performing efficient physiological experiments to determine auditory function, and statistical evaluation methods. Preparation of a potential publication will be the final part of the project. After completion, the individual projects will be presented and discussed in the form of a seminar talk. In a further seminar talk the students will present an original piece of research from the area of cognition and hearing.										
Educational Objectives / Competences										
Familiarity with carrying out well controlled behavioural experiments (animal handling, measuring and analysing behavioural data, statistical analysis). Performing physiological measurements including electrophysiological recording in minimally invasive preparations. Additional aspects are: introduction to software for data handling, signal processing, and graphical display. Deriving scientific questions from the current literature. Knowledge about the usage and limitations of animal models for neurological diseases.										
Recommended Requirements										
none										
Requirements for participation										
none										
Module Assignmet (Studiengang / Fachbereich)			Master Course of FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Dates and Module Frequency			Annually in the first part of summer term							
Duration			4-5 weeks, full-time							
Module Responsible			PD Dr. B. Gaese							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar							
Forms of Learning			practical course, seminar, self-studies							
Language			English							
Module completion test			Form / duration / content (if applicable)							
Module completion test			A protocol of 10-30 pages must be drafted							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10		X				
	Seminar	[S]	1	1		X				
	Module completion test									
	Sum		11	11						

MSc PBioC: 14	Information Processing in the Central Auditory System	Elective Module	11 CP (sum) = 330 h						11 SWH	
			Contact-studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>The practical covers the whole range of techniques to investigate brain activity underlying the processing of sensory information in the auditory domain. The focus is on electrophysiological single cell techniques in rodents in the awake and anesthetized preparations. Brain activity is acquired and analysed with the goal to understand behavioural responses following auditory stimulation. Cognitive aspects (e.g. context-dependence) are taken into account. The students work on their own projects under supervision and present their results in the form of a seminar talk. The main focuses are measuring and analysing neuronal activity in different configurations of in-vivo recording techniques. The following analysis includes modern techniques of signal processing, efficient handling of larger data sets and statistical evaluation methods. Preparation of a potential publication will be the final part of the project. After completion, the individual projects will be presented and discussed in the form of a seminar talk. In a further seminar talk the students will present an original piece of research from the area of cognition and hearing.</p>										
Educational Objectives / Competences										
<p>Familiarity with carrying out physiological experiments (animal handling, surgery, measuring and analyzing electrical activity at the single neuron level. Combining physiology with neuroanatomical and histological staining techniques. Basic introduction to behavioural control. Introduction to software for data handling, signal processing, statistical analysis and graphical display. Understanding cognitive influences on sensory information processing as an important aspect of context-dependent behaviour. Deriving scientific questions from the current literature.</p>										
Recommended Requirements										
none										
Requirements for participation										
none										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience						
Dates and Module Frequency				Annually in the first part of summer term						
Duration				4-5 weeks, full-time						
Module Responsible				PD Dr. B. Gaese						
Proof of Study										
Proof of Participation				none						
Course Assessment				20-30 min presentation in the seminar						
Forms of Learning				practical course, seminar, self-studies						
Language				English						
Module completion test				Form / duration / content (if applicable)						
Module completion test				A protocol of 10-30 pages must be drafted						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10		X				
	Seminar	[S]	1	1		X				
	Module completion test									
	Sum		11	11						

MSc PBioC: 15	Developmental Neurobiology	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents					
This module is terminated in winter term 2016/17!					

MSc PBioC: 16	Physiology and Behaviour	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
<p>The module teaches physiological bases of behaviour control. Students will work on individual projects that are jointly designed. The techniques taught may comprise cell physiology (patch clamp, calcium imaging, extracellular recording), Neuroanatomy, behavioural experiments (behavioural pharmacology, learning and memory). Model organisms are insects, mainly the honey-bee. Conceptual focusses are: function of ion channels and transmitter receptors, neuromodulation, learning behaviour, olfaction, social behaviour of honeybees.</p> <p>The students will give oral presentations of their results and will create a scientific poster summarizing their experiments. In a second seminar talk they learn to critically present physiological and behavioural articles. Presentations, seminars and posters will be given in English and the students receive detailed feedback on their presentation style as well as on the scientific contents. By writing a protocol in a manuscript style the students get acquainted with preparing a manuscript draft for submission to a science journal.</p> <p>The students will be responsible – under supervision – for the study design, protocolling and analysing the original data. Each step will be developed during the course rather than working after a pre-defined protocol.</p>										
Educational Objectives / Competences										
Planning, conducting and analysing of behavioural physiological experiments; measuring of ionic currents; behavioural observations and quantifications; neuroanatomical methods. Approaching scientific topics; literature work. Preparing of scientific texts, posters and talks.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			First half of winter and first half of summer term							
Duration			4-5 weeks, full-time							
Module Responsible			Prof. Dr. B. Grünewald							
Proof of Study										
Proof of Participation			none							
Course Assessment			30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning										
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			A protocol of 10-30 pages must be drafted							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBiOC: 17	Three-Dimensional Cell Cultures and Three-Dimensional Microscopy	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
<p>This internship teaches the basic concepts of three-dimensional cell biology and modern three-dimensional microscopy. The observation of live biological specimens under physiologically relevant conditions becomes increasingly important in the Life Sciences. Healthy as well as tumour cell lines, primary cells as well as stem cells, are cultivated and analysed under physiological conditions. These conditions are achieved with organ slices and three-dimensional cellular spheroids by growing them in collagen and many other hydrogels that mimic the extracellular matrix (e.g. Matrigel). Quantitative analyses of living three-dimensional structures requires fast optical sectioning. Confocal microscopy is only useful for relatively thin specimens, because of its slow scanning speed, high photo-bleaching rate and low efficiency in collecting light from thick specimens. Light sheet-based fluorescence microscopy in conjunction with three-dimensional specimen preparation techniques provides a suitable alternative. Students will participate in current research projects of the Stelzer group and are supervised by experienced members. They present their results in an oral presentation and in a written internship report.</p>										
Educational Objectives / Competences										
<p>The student learns the basic concepts of classical two-dimensional as well as three-dimensional cell culture. She or he is aware of several applications of three-dimensional cell cultures and knows which cell types are used in the Life Sciences. He or she understands the principles of optics in classical microscopy (characteristics of light, resolution, aperture) as well as photometry (energy, power). The student knows the differences between confocal and light sheet-based fluorescence microscopy and is able to estimate the limits of classical light microscopy in dense tissues. She or he masters the formation, isolation and staining of spheroids, cysts, organoids and three-dimensional tissue slices. The student has experience in the preparation of the specimens for different microscopes as well as the acquisition and processing of the images and the analysis of the data. At the end of the module the student presents the results in a written report and a talk</p>										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Master] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer term							
Duration			5 weeks, full-time							
Module Responsible			Prof. Dr. E.H.K. Stelzer							
Proof of Study										
Proof of Participation			none							
Course Assessment			presentation in the seminar to the experimental results of the scientific studies (15 min (+5 min discussion)), 5 min presentation to introduce the project,							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Internship report, protocol of 15-30 pages.							
Cumulative Module Completion Test consists of			none							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 18	Three-Dimensional Developmental Biology and Three-Dimensional Microscopy	Elective Module	11 CP (sum) = 330 h				11 SWH			
			Contact-studies 11 SWH / 165 h		Self-studies 165 h					
Contents:										
<p>This internship teaches state-of-the-art three-dimensional fluorescence microscopy and respective non-invasive sample mounting techniques. All steps are shown exemplarily in the investigation of insect embryogenesis. For more than a century, insect research has contributed significantly to genetics and developmental biology. The most prominent model organism is the common fruit fly/vinegar fly <i>Drosophila melanogaster</i>. However, over the last years it became apparent that focusing on a few established model organisms is not sufficient to understand the basic principles of insect development in detail. New insect species (emerging model organisms) are established in many laboratories to gain new insights into neglected or even unknown processes. For example, the red flour beetle <i>Tribolium castaneum</i> is used since its embryogenesis deviates substantially from that of <i>Drosophila</i> in many different aspects. Instead of wide field or confocal fluorescence microscopy, we use light sheet-based fluorescence microscopy, which allows us to image individuals for one week. Moreover, the imaged individual survives the procedure. Students will work on current research projects and are supervised by experienced members of the Stelzer group. They present their results in an oral presentation and a written internship report.</p>										
Educational Objectives / Competences										
<p>The student learns the principles of insect model organisms, such as <i>Tribolium castaneum</i>, in developmental biology. He or she is aware of current scientific questions in developmental biology and knows how to handle transgenic organisms. He or she understands the principles of optics in classical microscopy (characteristics of light, resolution, numerical aperture) as well as photometry (energy, power). The student knows the differences between confocal and light sheet-based fluorescence microscopy and is able to estimate the limits of classical light microscopy in dense tissues. He or she understands laboratory cultivation of <i>Tribolium</i> as well as preparation methods for confocal and light sheet-based fluorescence microscopes, in the context of long-term live imaging of <i>Tribolium</i> embryos <i>in toto</i>. The student analyses the data and understands the basics of scientific image processing and the embryonic development of <i>Tribolium</i>. The interns work under guidance on their own individual project based on the actual research topics of the Stelzer group. At the end of the course, they summarize their results and findings in a protocol and prepare a seminar under the guidance of their advisor.</p>										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Summer and winter term							
Duration			5 weeks, full-time							
Module Responsible			Prof. Dr. E.H.K. Stelzer							
Proof of Study										
Proof of Participation			none							
Course Assessment			presentation in the seminar to the experimental results of the scientific studies (15 min (+5 min discussion)), 5 min presentation to introduce the project							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Internship report, protocol of 15-30 pages.							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test, Protocol									
	Sum		11	11						

MSc PBioC: 19	Three-Dimensional Plant Cell Biology and Three-Dimensional Microscopy	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents:					
This module is terminated in summer term 2018!					

MSc PBioC: 20	Cell Communication, Cell Adhesion and Cell Motility	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents:					
This module is terminated in winter term 2017/18!					

MSc PBiOC: 21	Plant Cell Biology	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
<p>The practical course teaches basic techniques and experimental concepts of molecular cell biology and special questions of cellular and molecular aspects of plant physiology.</p> <p>Key features are: protein biochemical methods to study protein translocation and dynamics of chloroplasts, including subcellular fractionation, basics in plant cell culturing and transgenic (genetically modified) plants, in vivo and in situ measurement of protein activity and localization including digital image processing.</p> <p>The students will learn the handling of genetically modified plants, plant cell cultures and protoplasts e.g. culturing, passaging and transfection for ectopic expression or knockout of genes. The analysis comprises a broad spectrum of molecular biological and cell biological techniques like PCR, cloning, SDS-polyacrylamide gel electrophoresis, western blotting, immunofluorescence, measurement of protein activity and so on.</p> <p>The students work under supervision on their own scientific project which is leaned on the scientific work of the study group and present their experimental results in form of a seminar lecture. In another lab meeting the students present a recent publication on the field of cellular and molecular plant physiology. By performing a protocol with own scientific results, the students learn to write a scientific paper.</p>										
Educational Objectives / Competences										
<p>Skills taught: Knowledge to isolate plant cell organelles, independent characterization of organelle proteins, sterile working, culturing and transfection of cells, working with the fluorescence microscope and computational evaluation of experimental data and image files, knowledge in the analysis of transgenic plants, independent handling of scientific questions in the context of relevant scientific literature.</p>										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-5 weeks, full-time							
Module Responsible			Prof. Dr. E. Schleiff							
Proof of Study										
Proof of Participation			none							
Course Assessment			Protocol (10-30 pages), 20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Graded presentation (approx.. 30 min) with an introduction, presentation of the relevant literature, material and methods, results and a discussion							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 22	Fungal Cell Biology	Elective Module	11 CP (sum) = 330 h		11 SWH
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents:					
This module is terminated in winter term 2021/22!					

MSc PBioC: 23	Function and Evolution of Metabolic Pathways	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
<p>In this practical we will provide an understanding of basic methods and algorithms for the bioinformatics analysis of large datasets. The students will work on problems circling around the functional characterization and evolution of metabolic pathways and functional protein complexes. We will integrate latest high throughput DNA sequencing data into the analysis whenever possible and appropriate.</p> <p>Emphasis will be put on the compilation of novel sequence data sets for analyses, on data mining for complementation of existing data sets, as well as on the bioinformatics methods for comparison and annotation of sequence data. The theoretical foundation of the analyses will be formed by self-reliant literature research in combination with the presentation of a publication from the area of applied bioinformatics. Towards the end of the internship the students will exercise the correct way of presenting scientific results by summarizing their achievements in an oral presentation as well as in written form in a report.</p>										
Educational Objectives / Competences										
Independent conduct of functional annotation of sequences, of bioinformatics annotation transfer and of prediction of functionally equivalent proteins under consideration of evolutionary relationships; Ability for management and bioinformatics analysis of large sequence sets; Mining of public databases; Knowledge of relational database systems; Generation and interpretation of phylogenetic profiles; Introduction into independent scientific research on the background of relevant literature.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-5 weeks, full-time							
Module Responsible			Prof. Dr I. Ebersberger							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages) or poster							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 24	Special Aspects of Immunology	Elective Module	11 CP (sum.) = 330 h						11 SW H	
			Contact-studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>In the practical course the students work on current projects of the working group. Main topics are immunological experiments in the murine system and in primary murine cells as well as primary human cell cultures.</p> <p>The analysis comprises a broad spectrum of immunological and cell culture techniques such as: FACS, ELISA, Plaque-Assay, viral Infections, (q)RT-PCR, and the culturing of primary human cells and the isolation of different cell types from blood donors as well as the separation of cells with MACS and Cell-Sorter.</p>										
Educational Objectives / Competences										
<p>The students will learn to plan and to perform complex immunological experiments.</p> <p>The results of the practical course are presented by every student on the form of a written protocol and a talk at the end of the course. The students also take part on the weekly lab meetings where they learn about the ongoing research of all the members of the group. In a Journal Club every student learns to presents a recent publication on the field of immunology and in context of their own projects.</p>										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience						
Module Frequency				Annually in summer term an winter term						
Duration				4-5 weeks, full-time						
Module Responsible				Prof. Dr. Z. Waibler This module will be performed under responsibility of the head of the examination board.						
Proof of Study										
Proof of Participation										
Course Assessment				20-30 min presentation in the seminar to the experimental results of the scientific studies						
Forms of Learning				Practical, seminar, self-studies						
Language				German and English						
Module Completion Test				Form / duration / content (if applicable)						
Module Completion Test consists of				Protocol (10-30 pages)						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 25	Developmental Genetics	Elective Module	11 CP (sum) = 330 h				11 SWH			
			Contact-studies 11 SWH / 165 h		Self-studies 165 h					
Contents:										
<p>This practical course offers basic theoretical and experimental knowledge in the area of developmental genetics. Principal areas of research are the development, function and homeostasis of vertebrate organ systems including the cardiovascular system, lung and pancreas. The students take part on ongoing experiments in the laboratory to elucidate the cellular and molecular mechanisms underlying these processes. Their work includes: basic zebrafish or mouse genetics techniques and the handling of a zebrafish or mouse colony, live imaging of zebrafish embryos and larvae, processing of embryos or tissues for in situ hybridization and immunohistochemistry, immunofluorescence microscopy, confocal microscopy, molecular biology, embryological techniques (DNA and RNA injections into zebrafish embryos).</p> <p>The results of the practical course are presented by each student in the form of a written report as well as a talk at the end of the course. The students also take part in the weekly lab meetings where they learn about the ongoing research of all the members of the group. In a Journal Club each student presents a recent publication in the field of their own project</p>										
Educational Objectives / Competences										
<p>Students learn the basic techniques to study cellular and molecular aspects of developmental genetics (as detailed above). By the end of the course they have been in direct contact with zebrafish or mice and learn how to handle a zebrafish or mouse colony. The students are in an international environment and learn how to write and communicate their results in English</p>										
Requirements for Participation										
<p>The students should have a strong interest in developmental genetics. Some theoretical (and preferably practical) knowledge of basic molecular techniques and cell biology is expected.</p>										
Recommended Requirements										
<p>none</p>										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			5 weeks, full-time							
Module Responsible			Prof. Dr. D. Stainier							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages)							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X					
	Seminar	[S]	1	1	X					
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 26	Cell Biology and Gene Expression Control	Elective Module	11 CP (sum) = 330 h		11 SW H
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
This module is terminated in winter term 2019/20!					

MSc PBioC: 27	Endothelial Cells and Tumour Cell Biology	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
This training aims at teaching theoretical knowledge and practical experience in the fields of cellular and molecular biology, more specifically in the fields of endothelial and tumour cell biology. The student(s) will participate in ongoing projects in the lab, including the possibility to work on mice as model organism (depending on the project and availability- under supervision). The student(s) will also participate in regular meetings, and the obtained data will be summarized in a written protocol. The lab-atmosphere is international.										
Educational Objectives / Competences										
This training aims at learning different techniques from the above-mentioned fields, including cell culture of cell lines and primary cells, siRNA-mediated knock-down of genes, preparation of histological sections including staining, confocal microscopy and image analysis, PCR, Western blots, immunoprecipitation, etc.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer term							
Duration			4-5 weeks, daily							
Module Responsible			Dr. B. Strlic This module will be performed under responsibility of the head of the examination board.							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages)							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 28	Principles of Tube Morphogenesis	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents:										
In this course, we will offer you the opportunity to learn basics of the theory and experimental techniques in cell biology, biochemistry and physiology. The course is especially focusing on tube formation processes during vascular and kidney epithelial morphogenesis. The students will be involved in ongoing projects in the laboratory to address molecular mechanisms underlying these processes. The work includes: molecular cloning, basic protein purification, gel electrophoresis, western blot, cell culture of both primary cell and established cell line, immunohistochemistry using cultured cells and tissues, genotyping of transgenic mice, isolation of mouse tissue, immunofluorescence and confocal microscopy observation.										
Educational Objectives / Competences										
In the journal club you will present a recent paper. In the end of the course, you will have an opportunity to present your progress during the course. You will work in a very international environment. All of the communication is in English.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-5 weeks, daily							
Module Responsible			Dr. M. Nakayama This module will be performed under responsibility of the head of the examination board.							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages)							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 29	Developmental Cell Biology	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
<p>The practical course offers basic theoretical and experimental knowledge in the area of developmental cell biology. Principal areas of research are the mechanisms underlying cell migration and morphogenesis during organ formation using the zebrafish. Our main model system is the lateral line, a sensory system present in fish that derives from a group of cells that migrate in a collective manner. The students take part in ongoing experiments in the laboratory to elucidate, for example, the mechanisms underlying cell migration, cell differentiation, cell shape changes or cell proliferation in this system. The techniques used include basic genetics techniques, molecular biology, in situ hybridization and immunohistochemistry as well as handling zebrafish (crossing, injection, genotyping) and confocal and live imaging.</p> <p>The results of the practical course are presented by every student on the form of a written protocol and a talk at the end of the course. The students also take part on the weekly lab meetings where they learn about the ongoing research of the members of the group. In a Journal Club every student presents a recent publication on the field of their own projects.</p>										
Educational Objectives / Competences										
Students learn the basic techniques of molecular and developmental biology including zebrafish handling and modern live imaging techniques as detailed above. By the end of the course they have been in direct contact with mice and learn how to handle a mouse colony. The students are in an international environment and learn how to write and communicate their results in English.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-5 weeks, daily							
Module Responsible			Prof. Dr. V. Lecaudey							
Proof of Study										
Proof of Participation			none							
Course Assessment			20-30 min presentation in the seminar to the experimental results of the scientific studies							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages)							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
		Practical	[P]	10	10	X	X			
		Seminar	[S]	1	1	X	X			
		Module Completion Test								
		Sum		11	11					

MSc PBioC: 30	Basics and Appliance of Image and Data Analysis in Biology	Elective Module	11 CP (sum) = 330 h		11 SW H
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
Contents					
This module is terminated in summer term 2018 and is replaced by module 37!					

MSc PBioC: 31	Biology of Extracellular Vesicles	Elective Module	11 CP (sum) = 330 h						11 SW H	
			Contact-studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>Extracellular vesicles are released membrane vesicles from all cells which contain functional proteins as well as nucleic acids. The communication between cells via extracellular vesicles is a relative new and complex field of research.</p> <p>In the practical course the students will get an introduction to extracellular vesicles.</p> <p>Main points are the aspects of purification, classification, analysis of RNA-Protein content as well as visualization and transfer analysis of functional molecules between cell populations in vitro and in vivo.</p> <p>The students will work with different cell culture techniques, immunofluorescence microscopy, flow cytometric analysis and other related techniques.</p>										
Educational Objectives / Competences										
<p>The students will get knowledge and first experience in the field of Biology with extracellular vesicles and the communication via extracellular vesicles. They learn basic techniques to work with vesicles and they will learn to analyze the biological function. Students will be familiarized with scientific literature and learn how to write, communicate and present their results in English.</p>										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience						
Module Frequency				Annually in summer and winter term						
Duration				4-5 weeks, daily						
Module Responsible				Dr. Stefan Momma This module will be performed under responsibility of the head of the examination board.						
Proof of Study										
Proof of Participation				none						
Course Assessment				20-30 min presentation in the seminar to the experimental results of the scientific studies; protocol (10 – 30 pages)						
Forms of Learning				Practical, seminar, self-studies						
Language				English						
Module Completion Test				Form / Duration						
Module Completion Test consists of				Poster or Protocol (10-30 pages)						
		LV-Form	SW H	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 32	Special Aspects of Tumour Biology	Elective Module	11 CP (sum) = 330 h		11 SW H
			Contact-studies 11 SWH / 165 h	Self-studies 165 h	
This module is terminated in winter term 2019/20!					

MSc PBioC: 33	Cellular RNA Biology	Elective Module	11 CP (sum) = 330 h		11 SW H					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
<p>In the practical course basics in RNA Biology and animal cell culture will be learned. The students will learn and perform the analysis of RNA expression and RNA-protein-interactions in cells. The students will work under supervision on their own scientific project which is leaned on the scientific work and ongoing experiments of the working group of AK Müller-McNicoll. The experimental results will be presented in a seminar and in form of a graded protocol. During the practical course the students learn to work with different eukaryotic cell lines, the production and transfection of siRNAs to knockdown specific proteins of interest, the purification of RNA-binding proteins from cells and the identification and quantification of bound RNAs via quantitative RT-PCR or other methods.</p> <p>Other techniques comprise immunofluorescence microscopy, PCR, western Blotting, DNA-cloning, mutagenesis of proteins, subcellular fractionation and differentiating of cells.</p>										
Educational Objectives / Competences										
<p>Students will be familiarized with scientific literature; will have additional knowledge in RNA biology and special methods of transcript analysis.</p> <p>They will get practical experience in sterile working with cells and their analysis. At the end of the course they will be able to work with cell cultures for further analysis. They learn how to write, communicate and present their results in English language.</p>										
Requirements for Participation										
none										
Recommended Requirements										
As a basic knowledge, the theoretical foundations of molecular techniques and cell biology are expected. English language skills are required as all laboratory and literature seminars are held in English.										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience						
Module Frequency				Annually in summer and winter term						
Duration				5-6 weeks, daily						
Module Responsible				Prof. Dr. M. Müller-McNicoll						
Proof of Study										
Proof of Participation										
Course Assessment				30 min presentation in the seminar on the experimental results of the scientific studies and on the current literature, protocol (10 – 30 pages)						
Forms of Learning				Practical, seminar, self-studies						
Language				English						
Module Completion Test				Form / duration / content (if applicable)						
Module Completion Test consists of				Protocol (10-30 pages)						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 34	Neuronal basis of acoustic communication in mammals	Elective Module	11 CP (sum) = 330 h						11 SWH	
			Contact studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>The main goal of this course is to understand how mammals communicate using acoustic information (sounds). The course is designed from the perspective of the “broadcaster-receiver” approach, and therefore it is consequently subdivided into two parts. The first part is meant for understanding the sounds broadcasted by two mammalian species (Mongolian gerbils and bats) while they are communicating. Basically, using bioacoustics tools, the students will try to figure out the vocal alphabet of bats and gerbils. The second part of the course deals with the receiver. In this part, the students will learn how the gerbil’s voice is processed in the brain by neurons located in the auditory cortex. The main aim here is to assess what happens in the brain when an animal hears a behaviourally relevant sound. At the beginning of each course part, there will be introductory discussions that will provide the students with the necessary theoretical background for conducting and understanding the different experiments. An introduction to statistics and to MATLAB will also be offered. The final report will be written in the form of a scientific paper, and the results will be presented in the form of a short talk.</p>										
Educational Objectives / Competences										
<p>By the end of the course, the students should be able to: (1) Understand basic concepts of bioacoustics such as the sound as a mechanical wave, sound transduction using microphones, analogue-to-digital conversion using sound cards. (2) Measure basic parameters of a sound wave (frequency, duration, intensity). (3) Perform basic surgeries required for acquiring neuronal data. (4) Understand basic neuroscience concepts such as: action potential, local field potential, receptive field, brain topography, spike clustering, brain oscillations. (5) Testing hypothesis using basic statistical tests (normality tests, parametric and non-parametric t-tests and analyses of variance (ANOVA)).</p>										
Recommended Requirements										
none										
Requirements for participation										
none										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master’s degree courses of study with integral part of Module 7 [Module for students from other Masters (Modul für Master anderer Masterstudiengänge)] as well as Master in Interdisciplinary Neuroscience						
Dates and Module Frequency				Once a year, summer semester						
Duration				5 weeks, full-time						
Module Responsible				Prof. Dr. Manfred Kössl, Dr. Julio Hechavarria						
Proof of Study										
Proof of Participation				Regular participation						
Course Assessment				1 seminar presentation on the results of one’s own experiments, 1 seminar presentation on recent scientific papers, work report						
Forms of Learning				Practical, self-study						
Language				English						
Module completion test				Form / duration / content (if applicable)						
Module completion test				Graded Protocol						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10		X				
	Seminar	[S]	1	1		X				
	Module completion test									
	Sum		11	11						

MSc PBioC: 35	Cellular, molecular and systemic Neurobiology in mouse and zebrafish	Elective Module	11 CP = 330 h				11 SWH	
			Contact study 11 SWH / 165 h	Self-study 165 h				
Contents								
<p>The practical course offers basic theoretical and experimental knowledge in the area of cellular, molecular and systemic neurobiology in mouse and zebrafish. The students work on their own projects under supervision and present the results in the form of a seminar talk. In a second seminar talk they present an original publication from the field of their projects. By writing a result protocol, they will learn how to write scientific reports.</p> <p>The practical course is divided in two units. The first part includes the following tasks: basic mouse genetic techniques, processing of brain tissue for immunohistochemistry, basic techniques of working with neuronal cell cultures, immunofluorescence microscopy, confocal microscopy, and biochemical techniques including protein gel electrophoresis and Western blotting. In the second part of the practical course, the students will be introduced to basic zebrafish genetics using methods in molecular biology and histological techniques, confocal microscopy and brightfield microscopy as well as zebrafish embryo manipulation and basic behavioural tests.</p>								
Objectives								
<p>Students learn the basic techniques for studying cellular, molecular, and systemic neurobiology (as detailed above). They work with cultured cells under sterile conditions, with the epifluorescence microscope and the stereo microscope. The students will be trained in zebrafish embryo handling and basic genetic techniques, and quantify and analyse the obtained data and images. The students are in an international environment and learn how to write and communicate their results in English.</p>								
Requirements for participating								
none								
Helpful previous knowledge:								
none								
Assignment of module (course/department)					Interdisciplinary Neuroscience / FB15			
Suitable for other courses					yes			
Times offered					Once per year; summer semester			
Duration					4 weeks			
Person in charge					Prof. Amparo Acker-Palmer, Dr. Bettina Kirchmaier			
Confirmation of completion								
Participation					Regular participation			
Course assessment					1 seminar talk on the results of one's own experiments, 1 seminar talk on current publications, work report			
Teaching forms					Practical, seminar, self-studies			
Tuition language					English			
Module exam					Form / duration / content (if applicable)			
Module completion exam					Graded protocol (10 – 30 pages)			
		Teaching form	SWH	CP	Semester			
					1	2	3	4
	Practical	[P], [S]	11	11		X		
	Module Completion Test							
	Sum		11	11				

MSc PBioC: 36	Basics and Appliance of Image and Data Analysis in Biology	Elective Module	11 CP (sum) = 330 h		11 SW H
			Contact-studies 11 SWH / 165 h	Self-studies 16h	
This module is terminated in winter term 2019/20!					

MSc PBioC: 37	Data analysis, mathematical modelling and simulation	Elective Module	11 CP (sum) = 330 h		11 SW H					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
<p>This module provides a foundation of theoretical biology in the form of individual student research projects, mainly based on examples of cell migration. Methods and techniques, which are hereby acquired and applied, range from data or image analysis (such as segmentation, tracking, dimension reduction of large data sets, or network analysis), to the modelling and simulation of motile cells. Examples of projects involving modelling and simulation are collective migration (of cancer cells or in developmental processes), chemotaxis, pattern formation, or the description of chemical or mechanical regulatory mechanisms of motility. Alternatively, data analysis, modelling or simulation can be carried out based on a project providing suitable data collected during a previous module.</p> <p>Image analysis will mostly be carried out using conventional software tools (ImageJ, Matlab). For post-processing of the data, visualization or statistical analysis the student will be supported in the generation of own software. The students may code in the programming language of their choice. For beginners, an introduction to programming (in Python, Matlab or Julia) is provided. Also modelling and simulation will involve the generation of code. The topic and results of the research project will be presented in the group seminar. In addition, every student will submit a protocol comprising 10 – 30 pages..</p>										
Educational Objectives / Competences										
<p>The goal of the module is to provide and extend programming skills, data analysis methods and modelling approaches for dynamical or spatio-temporal processes, or large data sets. Students should be able to apply these methods/approaches in their future research and use them as a foundation for further development. Independent research, usage of original literature, and scientific writing will be strengthened.</p>										
Requirements for Participation										
none										
Recommended Requirements										
Basic programming skills, basics of statistics, good background in mathematics and/or physics										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-5 weeks, daily							
Module Responsible			Prof. Dr. F. Matthäus							
Proof of Study										
Proof of Participation			Regular participation							
Course Assessment			20 min presentation (15 + 5 min) in the seminar covering the experimental results and a short review of the relevant literature.							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Protocol (10-30 pages).							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 38	Understanding the molecular mechanisms leading to Parkinson's disease	Elective Module	11 CP (sum) = 330 h		11 SWH					
			Contact-studies 11 SWH / 165 h	Self-studies 165 h						
Contents										
<p>In this practical course, students learn how to use the multicellular model organism <i>C. elegans</i> to investigate the early molecular mechanisms and cellular alterations leading to the development of Parkinson's disease. The inactivation and analysis of homologous genes that are associated with the hereditary form of Parkinson's disease, attempts to understand the function of these genes in normal cells. In addition, it will be investigated, which cellular alterations result from the inactivation of these genes and what conclusions can be drawn on possible early mechanisms of Parkinson's disease development.</p> <p>The generated mutant animals are genetically, biochemically and cell biologically examined using high-resolution microscopy techniques such as confocal microscopy and electron microscopy. The students learn how to use the model system <i>C. elegans</i> and the latest methods of genetic manipulation such as CRISPR/Cas9-mediated genome editing or RNAi gene knockdown as well as quantitative evaluation of microscopy data. The students present their results in a seminar talk and in the form of a graded protocol.</p>										
Educational Objectives / Competences										
During the internship, students learn how genetic manipulation and analysis of a multicellular model organism can help to understand complex cellular relationships that can lead to the development of neurodegenerative disorders.										
Requirements for Participation										
none										
Recommended Requirements										
none										
Module Assignmet (Studiengang / Fachbereich)			Master PBioC - FB 15							
Applicability to other course of study			FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience							
Module Frequency			Annually in summer and winter term							
Duration			4-6 weeks, daily							
Module Responsible			Prof. Dr. S. Eimer							
Proof of Study										
Proof of Participation			Regular participation							
Course Assessment			Work report							
Forms of Learning			Practical, seminar, self-studies							
Language			English							
Module Completion Test			Form / duration / content (if applicable)							
Module Completion Test consists of			Graded presentation with discussion							
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Sum		11	11						

MSc PBioC: 39	Cellular and molecular mechanisms in neurodegenerative disorders	Elective Module	11 CP (sum) = 330 h						11 SWH	
			Contact-studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>The practical course offers basic theoretical and experimental knowledge in the area of neurodegenerative and vascular disorders. The students work on their own projects under supervision and present the results in the form of a seminar talk. This talk also includes an original publication from the field of their projects. By writing a result protocol, they will learn how to write scientific reports.</p> <p>The practical course consists of systemic, cellular and molecular aspects that will be addressed. This includes the following techniques: <i>in vivo</i> 2-Photon Microscopy, Image- and data analysis, basic mouse genetic techniques, processing of brain tissue for immunohistochemistry, basic primary cell culture techniques, immunofluorescence microscopy, confocal microscopy as well as biochemical techniques including protein gel electrophoresis and Western blotting.</p>										
Educational Objectives / Competences										
<p>In this elective module, the student will learn fundamental techniques used to in the research area of neurodegenerative disorders (as described above) by using the mouse model organism. <i>In vivo</i> 2-Photon imaging enables us to record systemic as well as cellular processes in real time. The students are presented with the opportunity to observe <i>in vivo</i> animal handling and the live imaging process. The acquired data will be analyzed by the students, teaching them basic Image- and data analysis skills. The immunohistochemical stainings of brain sections will teach the students the technique as well as the underlying scientific question of the experiment. Moreover, the students will work with cultured cells under sterile conditions, with the epifluorescence – and stereo microscope. The students are in an international environment and learn how to write and communicate their results in English.</p>										
Requirements for Participation										
None										
Recommended Requirements										
None										
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15						
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience						
Module Frequency				Annually in summer term						
Duration				4-5 weeks, daily						
Module Responsible				Prof. Dr. J. Hefendehl This module will be performed under responsibility of the head of the program.						
Proof of Study										
Proof of Participation				Regular participation						
Certificate of Performance				20 min presentation (15 + 5 min) in the seminar covering the experimental results and a short review of the relevant literature.						
Forms of Learning				Practical, self-studies						
Language				English						
Module Completion Test				Form / duration / content (if applicable)						
Module Completion Test consists of				Graded protocol						
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical course	[P]	11	11		X				
	Seminar									
	Module Completion Test									
	Summ		11	11						

MSc PBioC: 40	Molecular Psychiatry	Elective Module	11 CP (sum) = 330 h						11 SWH	
			Contact-studies 11 SWH / 165 h			Self-studies 165 h				
Contents										
<p>In this practical course the molecular and cellular causes of psychiatric disorders will be explored. Students will be introduced to a broad spectrum of translational methods. These include cell culture techniques for the functional study of candidate genes (including the production of primary cell cultures from humans and/or mice, production of viral vectors and viral gene transfer), molecular and cell biological mechanisms in the cell model and/or optionally in the mouse model (including behavioural biology in mice that have been genetically modified and/or pharmacologically treated). Following such experiments, various molecular biological (including quantitative PCR, Western blot, ELISA), neuroanatomical (brain preparation, cryostat cutting, staining methods), immunohistochemical and microscopic (including fluorescence microscopy with and without structured illumination) characterisations will be performed. It is also possible to gain insight into behavioral studies and imaging techniques (functional magnetic resonance imaging [fMRT], electroencephalography [EEG], magnetoencephalography [MEG]) used to evaluate abnormal neuronal processing in human psychiatric disorders.</p> <p>The experiments are carried out in the laboratories of the Department of Psychiatry, Psychosomatics and Psychotherapy of the University Hospital Frankfurt. Current projects of the department will be carried out under supervision. The results will be presented in a presentation in the lab seminar and documented in the form of a written report.</p>										
Educational Objectives / Competences										
Students can plan, carry out and analyse experiments used to investigate psychiatric disorders. Students learn and develop scientific approaches and literature research. The students document their results and communicate them in oral and written form. In a series of seminars (including the opportunity to participate in case presentations), students also acquire basic knowledge of the psychiatric disorders studied and are able to describe them.										
Requirements for Participation										
None										
Recommended Requirements										
None										
Module Assignmet (Studiengang / Fachbereich)						Master PBioC - FB 15				
Applicability to other course of study						FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Masters] as well as Master in Interdisciplinary Neuroscience				
Module Frequency						Annually in summer and winter term				
Duration						6 - 8 weeks				
Module Responsible						Dr. F. Freudenberg This module will be performed under responsibility of the head of the program.				
Proof of Study										
Proof of Participation						Regular participation				
Certificate of Performance						20 min presentation (15 + 5 min) in the seminar covering the experimental results and a short review of the relevant literature.				
Forms of Learning						Practical, seminar, self-studies				
Language						English				
Module Completion Test						Form / duration / content (if applicable)				
Module Completion Test consists of						Graded protocol (10 – 30 pages)				
		Teaching forms	SWH	CP	Semester					
					1	2	3	4	5	6
	Practical course	[P]	10	10	X	X				
	Seminar	[S]	1	1	X	X				
	Module Completion Test									
	Summ		11	11						

MSc PBioC: 41	Cardiovascular Development	Elective Module	11 CP (sum) = 330 h						11 SWH
			Contact-studies 11 SWS / 165 h			Self-studies 165h			
Contents									
<p>This course serves as an introduction into the basic theoretical and experimental field of cardiovascular development and their implications in congenital heart disease. The main model that is used in our lab is the mouse model system, which is complemented with cell biology work in primary cardiac cells isolated from mice or work with cell lines in vitro. The student takes over a subproject of the ongoing research in the lab. The focus of the lab is the contribution of long non-protein coding RNAs (lncRNAs) to various cell regulatory process in the cardiac system. To this end, we genetically engineer mouse embryonic stem cells with CRISPR/Cas9 to generate genetic mutants of lncRNAs in heart development. In addition, we use other CRISPR technologies (e.g. CRISPRa (gene activation), CRISPRi (gene inactivation) and Cas13 (RNA inhibition) to modulate gene programs in either ex vivo or in vitro settings. Such engineered stem cells are differentiated into early cardiac cells in vitro or directly used to generate mouse embryos by our own pipeline. Any impact on cardiac development will be observed.</p> <p>At the end of the lab rotation the students will prepare a short, written report and will present their finding in the general lab meeting to the fellow lab members for discussion and possible future research direction. Students will participate in the weekly lab meetings and will get familiar with the ongoing research in the lab.</p>									
Educational Objectives / Competences									
The students will learn how to use various CRISPR systems to dissect gene regulatory programs in the cardiovascular system and related cells, which of course can be applied to any other field of research. They learn how to 'read' and interpret whole genome data to direct hypothesis on gene regulation and how to design genetic manipulation experiments to verify them.									
Requirements for Participation									
None									
Recommended Requirements									
Basic knowledge on sterile work on cultured cells.									
Module Assignmet (Studiengang / Fachbereich)				Master PBioC - FB 15					
Applicability to other course of study				FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Master programs] as well as Master in <u>Interdisciplinary Neuroscience</u>					
Module Frequency				Annually in summer and winter term					
Duration				4 weeks					
Module Responsible									
Proof of Study				Dr. P. Grote This module will be performed under responsibility of the head of the program.					
Proof of Participation				Regular attendance					
Certificate of Performance				20 min presentation (15 + 5 min) in the seminar covering the experimental results and a short review of the relevant literature.					
Forms of Learning				Practical, seminar, self-studies					
Language				English					
Module Completion Test				Form / Duration					
Module Completion Test consists of				Graded protocol (10-30 pages)					
Cardiovascular Development	LV- Form	SW S	CP	Semester					
				1	2	3	4	5	6
Practical	[P]	10	10	X	X				
Seminar	[S]	1	1	X	X				
Module Completion Test									
Sum		11	11						

MSc PBioC: 42	Investigating the molecular genetics of neuropsychiatry	Elective Module	11 CP (sum) = 330 h						11 SWH	
			Contact-studies 11 SWS / 165 h			Self-studies 165h				
Contents										
<p>In this module, the fundamentals are taught to decipher the molecular genetic mechanisms behind neuropsychiatric disorders such as autism or social behavior disorder. On the one hand, bioinformatic methods can be learned to identify genetic markers for the disorders, or to link transcriptome data from neuronal cell models to patient data in such a way that new insights into the cause of the disorder or biologically defined subgroups of patients can be identified. In particular, omics analyses as well as machine learning methods are used here. On the other hand, neuronal human cell models are generated based on the identified genetic markers (CRISPR/Cas9). Here, the students learn how to handle human cell models, especially human embryonic stem cells (hESC), induced pluripotent stem cells and especially the cultivation and quantitative evaluation (real-time PCR, confocal microscopy) of neuronal progenitor cells, differentiated neurons and cerebral organoids. The participant will discuss the results in our scientific seminars.</p>										
Educational Objectives / Competences										
<p>Through the practical course, students learn how to implement translational research approaches. In particular, they learn how to use molecular genetic and bioinformatics methods to link findings from the cell model with patient data and vice versa.</p>										
Requirements for Participation										
None										
Recommended Requirements										
Cell culture experience or preliminary bioinformatics knowledge..										
Module Assignmet (Studiengang / Fachbereich)						Master PBioC - FB 15				
Applicability to other course of study						FB 15 master's degree courses of study with integral part of Module 7 [Module for students from other Master programs] as well as Master in Interdisciplinary Neuroscience				
Module Frequency						Annually in summer and winter term				
Duration						6 -8 weeks				
Module Responsible										
Proof of Study						Prof. Dr. AG. Chiocchetti				
Proof of Participation						Regular attendance				
Certificate of Performance						20 min presentation (20 – 30 min) in the seminar covering the experimental results and the relevant literature.				
Forms of Learning						Practical, seminar, self-studies				
Language						English				
Module Completion Test						Form / Duration				
Module Completion Test consists of						Graded protocol (10-30 pages)				
Cardiovascular Development		LV-Form	SW S	CP	Semester					
					1	2	3	4	5	6
Practical		[P]	10	10	X	X				
Seminar		[S]	1	1	X	X				
Module Completion Test										
Sum			11	11						