

BIO-B-KM-1		Number of credit points (CP): 6		
Core module 1 – State of the Art in Biochemistry and Molecular Biology				
Module type (mandatory or elective module):		Depends on course of study		
Content and objective of module:		<p><u>Contents:</u> Current topics in biochemistry, biotechnology, molecular biology, genetics, cell biology and physiology with emphasis on eukaryotic and prokaryotic model organisms and the scientific fields of the participating professorships</p> <p><u>Objectives:</u></p> <p><u>1.) Subject competencies:</u></p> <ul style="list-style-type: none"> - Students acquire deep insights into the current state of research in selected topics in biochemistry, genetics, molecular biology, cell biology and physiology including suitable experimental approaches to solve scientific problems. <p><u>2.) Methodological competencies:</u></p> <ul style="list-style-type: none"> - Students learn to cope with specialist literature in English. <p><u>3.) Performance competencies:</u></p> <ul style="list-style-type: none"> - Students learn to ask questions after scientific talks in English. 		
Module (partial) exam(s) (number, form, scope):		Written exam, 120 min		
Independent study time (in hours):		90		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture circuit Biochemistry	2	-	-	-
Lecture circuit Molecular Biology / Genetics	2	-	-	
Lecture circuit Cell Biology / Physiology	2	-	-	
Frequency of the module:		summer semester		
Prerequisites for participation in the module:		-		
Responsibility:		Prof. Dr. Ralph Gräf		

BIO-B-KM-2		Number of credit points: 6		
Core module 2 - Practical Bioinformatics				
Module type:		Depends on course of study		
Content and qualification aims of the module:		<p><u>Content:</u> Lecture and exercise convey knowledge on the structure and usage of biological data bases and about systems biological aspects of the analysis and interpretation of high-throughput data containing information on cellular molecular components such as genes, metabolites and proteins.</p>		

		<p>Conveyed profession skills: The module conveys knowledge on resources on biological sequences, structures as well as metabolic pathways and ontologies freely available in the internet. Students are enabled to use the statistics tool box R and solve ambitious data analysis tasks independently with it.</p> <p><u>Qualification aims:</u></p> <p><u>1.) Profession skills:</u></p> <ul style="list-style-type: none"> - Students understand the application possibilities of bioinformatics tools and methods. - They know important bioinformatics resources for sequence and structure analysis. - They rule the foundations of descriptive and inferential statistics. <p><u>2.) Method skills:</u></p> <ul style="list-style-type: none"> - Students understand the mathematical and computational foundations of basic bioinformatics methods. - They are able to select for a given biological problem with corresponding measurement data the appropriate data analysis and interpretations methods. <p><u>3.) Action skills:</u></p> <ul style="list-style-type: none"> - Students are able to present and defend their work with appropriate presentation media to the public. - By team working during the presentation preparation students are able to work together in groups and to tackle together a scientific question. 		
Module exam:		Written exam, 90 min		
Tutorial time:		120		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and Exercise	4	-	Test (90 min)	-
Offer frequency:		summer semester		
Requirement for module participation:		-		
Offering chair:		Chair of Bioinformatics		

BIO-B-RM1	Number of credit points (LP): 11
Title of the module: Nanobiotechnology	
Type of module (compulsory or compulsory optional module):	Compulsory optional module
Contents and qualification objectives of the module:	<p><u>Contents:</u></p> <p>Basic methods of Nanobiotechnology and the scientific concept in relation to Biosensor Technology are taught. Different manipulation and detection techniques are presented and important combinations with</p>

	<p>biomolecules and sensors and their bioanalytical application are introduced. By means of practically relevant examples the development of single biosensors, their limitations and approaches of optimization are discussed. Further topics are biosensors, Biochip Technology, Molecular Diagnostics, Point of Care Testing (POCT).</p> <p>In the practical part methods of Nanobiotechnology are exemplarily applied and different biosensors are prepared, characterized and tested. For this purpose the students are taught different immobilization techniques for enzymes and proteins as well as different measurement techniques for the characterization of the sensor functioning. A special focus is placed on AFM techniques and optical biosensors. In the seminar current developments in the field of Nanobiotechnology are presented and discussed by the participants of the internship using specialist literature.</p> <p><u>Qualification Objectives:</u></p> <p><u>1.) Subject-specific competencies:</u> The module deals with the basics of Nanobiotechnology, Bioelectronics, Biochip Technology and Biosensor Technology and their techniques. The students are introduced to scientific ways of thinking and learn to develop experimental approaches. In the scope of the module students with a biotechnological and a biochemical orientation are taught specific knowledge in the field of Nanobiotechnology. It is independent from the specialisation chosen later and from the professional orientation.</p> <p><u>2.) Methodological skills:</u></p> <ul style="list-style-type: none"> - Using English technical literature - Documentation and presentation of scientific issues - Planning of scientific experiments, interpretation and documentation of results - Manual skills for laboratory practice <p><u>3.) Social and strategic competencies:</u></p> <ul style="list-style-type: none"> - The students are able to interact within a group and to work together in a team. - The students are able to plan, carry out and document experimental work. - The students are able to present and defend the results of the experiments in the framework of the seminar. 			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Own independent learning time (in hours):	95			
Courses (forms of teaching)	Time (in SWS)	Prüfungsnebenleistungen (??) (number, form, scope)		Module Examination (number, form, scope)
		For completion of the module	For admission to module examination	
Seminar Research topics of Nanobiotechnology/Biosensor Technology/	4			

Bioanalytics				
Lab course (6 weeks)	5			
Frequency of the course: winter semester				
Prerequisite for participation: -				
Teaching unit: Prof. Dr. Frank F. Bier				

BIO-B-RM2	Number of credit points (CP): 11
Cellular Signal Transduction	
Kind of the module (compulsory or elective module):	Elective module
Contents and objectives of the module:	<p><u>Contents:</u> This module gives information about theoretical and practically relevant knowledge in the field of intracellular signal transduction. The module focuses on the biochemistry of cellular animal systems, physiological processes of plants are partially included. The module covers subjects like receptors, heterotrimeric G-proteins, ion channels, intracellular second messengers, kinases, phosphatases, proteases, small GTP-binding proteins, regulation of the cell cycle, transcription factors as well as mechanisms for termination of signaling processes. Beside the theoretical basic principles the cellular signaling mechanisms are illustrated by examples from pathobiochemistry. It is intended to explain principles to improve the classification of the transfer of intracellular signals in the human body.</p> <p>This module is completed by attendance of the second part of the module 'Signal transduction II' in the summer semester. Here students present published articles which illustrate basic mechanisms of signal transduction by various clinical pictures. Techniques to rapidly cover the content of a publication and to transmit the take home message to an interested but also critical audience by using power point presentations and the blackboard are trained (multiplication). Additionally the assessment and critical appraisal of published data by reflection of the adequate questions, the used methods, the permitted conclusions which have been drawn from the shown data as well as the allocation of the topics into the context of the respective scientific field are practiced.</p> <p><u>Aims of qualification:</u> <u>1.) Professional expertise:</u> The students know the principles of biochemistry, molecular biology and immunology and have deepened knowledge in these fields. The students are able to reflect the relations between these different parts of scientific fields. The students are able to make scientific decisions into the frame of these fields.</p> <p><u>2.) Methodical expertise:</u> The students are able to handle with a given scientific question by making use of scientific methods. The students know how scientific theories and models are developed and are able to recommend well-founded modifications of standard methods. The students are able to adopt a scientific publication by themselves, to critically try to get the bottom of the published results and methods and to intelligibly illustrate the major contents to other students.</p> <p><u>3.) Decision-making and responsibility (societal relevant and</u></p>

	<u>strategic expertise</u> : The students are able to present and answer back their work to the community of the course by making use of appropriate presentation techniques. The students are able to work together in a team and to work out a problem.			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Written exam (90 min)			
Time for self learning (in hours (h)):	95			
Events (kind of lesson)	Contact time (in SWS)	Efforts for the examination beside (quantity, form, extent)		Examination part of the module (quantity, form, extent)
		Fort the completion of the module	Fort the admission of the module	
Lecture and Seminar	4	Presentation (20 min)		
Lab course (6 weeks)	5			
Frequency of the offer:	each summer- and winter semester			
Prerequisite for the participation in the module:	-			
Offering teaching unit:	PD Dr. Gaby-Fleur Böl			

BIO-B-RM3 Evolutionary Genomics (Evolution across Scales module D)		Number of credit points (CP): 11		
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of mod-ule:	<p>Content: This course covers approaches and applications of sequence bioinformatics, including the analysis of data from next generation sequencing technologies. The course focuses on comparative analyses of sequence data but also covers approaches for small- and large-scale phylogenetic inference as well as methods and applications of evolutionary genomics research.</p> <p>Objectives:</p> <p>1.) Subject competencies Students understand the principles of computational sequence analysis, also in an evolutionary context.</p> <p>2.) Methodological competencies Students are able to computationally analyze biological sequence data using publicly available software; they are also able to summarize and interpret the results of these analyses.</p> <p>3.) Performance competencies Students are able to critically read literature written in English and put content of an article into a broader perspective; students can independently work on sequence bioinformatics problems/projects.</p>			
Module (partial) exam(s) (number, form, scope):	Written exam, computer written exam (90 min) Written exam (90 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in	Supplementary exam work (Number, form, scope)	Modulprüfung (Anzahl, Form,	

	semester hours)	For completing the module	For admission to the module exam	Umfang)
Lecture and seminar: Bioinformatics / Evolutionary Genomics	4			
Computer lab course (2 weeks)	2	Written report (approx.. 20 pp.)	1 written exam	
Offered:				
	winter semester			
Prerequisite for taking the module:				
	-			
Teaching unit:				
	Professur für adaptive Genomik			

BIO-B-RM4 Antibody-Technologies	Amount of credit hours (ECTS): 11
Module (major or elective module):	Elective module
Contents and qualification outcomes of the module:	<p><u>Contents:</u> Within the lectures of the module Antibody-technologies participants will initially learn about fundamental topics in immunology. Lectures are going to be held in english. To intensify the insight into current scientific research, teaching includes the illustration of original scientific publications. Integration of those articles will extend the knowledge from textbooks with actual topics of immunological research. The seminar addresses publications as an important part of scientific work. This includes the examination with formal structures of scientific articles as well as the academic writing. During the practical training students will learn about the generation, purification and characterisation of monoclonal antibodies. Methods as affinity chromatography, culturing of eukaryotic cell lines or ELISA are used.</p> <p><u>Qualification outcomes:</u> <u>1.) Professional competences:</u> The students will be equipped with in-depth theoretical knowledge and hands-on skills in the field of immunology. Furthermore the students will be familiar with the basics of scientific writing, especially in form of scientific publications.</p> <p><u>2.) Methodological competences:</u> The students will be able to extrapolate fundamental contents, methods and results from scientific publications and gain basic knowledge how to author scientific publications. In addition they will be capable of using technical methods to process, document and evaluate a given interrogation.</p> <p><u>3.) Action competences (socially relevant and strategic competences):</u> The students will know how to present and defend scientific procedures and results in written form as well as verbal in front of the seminar participants. On that account they use media appropriate for presentations. The students will achieve the ability of planning, performing and analyzing experiments in immunology.</p>
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Presentation (15 min)
Private study time (in hours (h)):	95

Courses	Contact hours (in SWS)	Supplementary work (count, form, volume)		Module partial examination (count, form, volume)
		for the degree	for admission to the examination	
Lecture and seminar	2 + 1		Active participation at the discussion	
Lab course (6 weeks)	5			
Frequency		Summer semester		
Prerequisites needed		-		
Provided by:		Course leader: Prof. Dr. Katja Hanack Lecturer: Prof. Dr. Katja Hanack, Steffi Lütkecosmann		

BIO-B-RM5		Number of credit points (CP): 11	
Name of modul: Novel cloning technologies for future biotechnology			
Module type (mandatory or elective module):	Richtungsmodul		
Content and objective of mod-ule:	<p><u>Content:</u> The modul consists of lecture, seminar and practical training. Main area of interest for this modul is the generation and integration of artificial biochemical pathways into organisms like bacteria and plants. As the construction of highly complex pathways is nearly impossible with standard cloning methods, the modul will introduce the students to novel cloning technologies for future construction of genes and genomes. Lecture will give main basic aspects of novel cloning technologies and biological pathways. Seminar will introduce examples and show the usage of appropriate software tools. Practical training deals with design of artificial pathways and planning of needed cloning strategies.</p> <p><u>Objectives:</u> <u>1.) Subject competencies:</u> Students get deepened theoretical and practical knowledge in the field of synthetic biology and biotechnology.</p> <p><u>2.) Methodological competencies:</u> Students are able to gather the basics, methods and results of peer-reviewd publication. Students are able to design artificial biochemical pathways and cloning strategies with subject-specific software tools.</p> <p><u>3.) Performance competencies:</u> Students are able to present and discuss scientific aproaches in written as well as orally using appropriate presenting media. Students are able to design, conduct and analyze biochemical pathways and cloning strategies self-reliantly.</p>		
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Presentation (20 min)		
Independent study time (in hours):	95		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)	Module (partial)

		For completing the module	For admission to the module exam	exam(s) (Number, form, scope)
Lecture	2			
Seminar	1			
Lab course (6 weeks)	5			
Offered:		Sommer semester		
Prerequisite for taking the module:				
Teaching unit:		Modulverantwortlicher: Prof. Dr. Bernd Müller-Röber Durchführung: Dr. Katrin Messerschmidt, Dr. Yariv Brotman		

BIO-B-RM6 Animal Models in Developmental Biology and Cell Physiology (Depends on course of study)	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p>The lecture and the seminar will focus on basic topics and current research questions related to the development and physiology of different animal model organisms. There will be an emphasis on comparative aspects of development and physiology in invertebrates (e.g. <i>Drosophila</i>) and in vertebrates including the zebrafish, mouse and rat.</p> <p>The lecture will provide a broad overview of developmental concepts and processes that have been discovered in these animal models. There will also be an extensive theoretical introduction to the relevant methodology. In addition to classical genetic techniques, the lecture will introduce students to modern molecular and genetic tools including “OMICS” technologies, different methods of mutagenesis such as the CRISPR/Cas9 technology, transgenesis methods and genetic tools that have been developed for intravital imaging (e.g. the brainbow technology).</p> <p>This module will provide students with a basic understanding of animal development and physiology and also of the methodology that is available to researchers working on these topics. Students will be introduced to the scientific background and to experimental methods relevant to animal development and physiology. This module is directed towards students with a strong interest to specialize on molecular and cellular aspects of developmental and physiological processes as part of their Masters course.</p> <p>The seminar will introduce students to the critical reading and assessment of primary research literature relevant to this topic. Students will present research papers to both their peers and teachers and learn to discuss and criticize the conclusion of these original works of research. The students will learn how to present their work to a scientific audience using appropriate media and to deal with questions and/or comments in a scientific discussion. These discussions will also open the possibility to review potential future research directions.</p> <p>The practical work will involve the cell biological and physiological analysis of animal development, with a particular emphasis on zebrafish. It will be oriented along current research</p>

	questions addressed in the Seyfried group. Methods to be used will include among others genetic and phenotypic analyses of zebrafish and invertebrate models using light and fluorescence microscopy.			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture an seminar: Animal Models in Developmental Biology and Physiology	4		presentation	
Lab course (6 weeks)	5			
Offered:	Each winter semester			
Prerequisite for taking the module:	for students enrolled in the Master program „Biochemie und Molekularbiologie“			
Teaching unit:	AG Zoophysiologie			

BIO-B-RM7 Bioelektronics	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p><u>Content:</u> The course deals with the concept of biosensors. Topics are various detection and transduction techniques, coupling principles of biomolecules and sensors and their bioanalytical application. The development of biosensors, their limitations as well as solutions to the problems for optimization will be discussed for examples relevant for research and application. Further topics are bioelectrochemistry, biochip technology, molecular diagnostics, point of care testing and nanotechnology. The seminar deals with recent developments in the field of bioanalytics with special attention to nanobiotechnology, point of care diagnostics und bioelectronics. Original publications addressing individual topics will be presented by each student and critically discussed with the group. In the practical part the students will work on a one aspect of a ongoing research project in the field of biosensors-bioelectronics.</p> <p><u>Objectives:</u> <u>1.) Subject competencies:</u> The modul deals with basics of biosensorics, molecular diagnostics, bioelectronics, biochiptechnique and nanobiotechnology and their techniques. The students are expected to learn how to solve scientific questions and how to approach them. The students will be familiarized with the theoretical background, scientific approach and experimental methods. The module will teach students specialized knowledge and capabilities in the analytical biochemistry for students interested in the field of biotechnology and biochemistry. It analysis of biological and biochemical</p>

	<p>processes; as such it forms a central part of the Masters course when intending to specialize on biochemistry independent on the intended specialization.</p> <p><u>2.) Methodological competencies:</u> Students will learn how to read and critically evaluate original scientific literature in English. Students will learn how to extract the essential points from original scientific literature. Students will learn how to evaluate and present and document scientific data Students will learn how to plan and perform scientific experiment</p> <p><u>3.) Performance competencies:</u> -The students are able to plan, perform, evaluate, critically discuss experimental work. They can work out documentations. -Students learn to interact in a team. - Students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - Students can ask concise, to-the-point questions about possible future research directions to follow up a given problem.</p>			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and seminar Forschungsthemen der Biosensorik	4	Presentation (20 min)		
Lab course (6 weeks) Biosensors-bioelectronics	5			
Offered:	Winter semester			
Prerequisite for taking the module:	In Frage kommt das Modul für Studierende mit einem abgeschlossenen Bachelor –Studium in Biologie, Biochemie, Biotechnologie.			
Teaching unit:	Prof. Dr. Ulla Wollenberger			

BIO-B-RM8 Immunotechnology	Number of credit points (CP): 11
Type of module:	Richtungsmodul
Contents and objectives of the module:	<p><u>Content:</u> The module serves to deepen immunological and biotechnological knowledge. Particular emphasis is given to biotechnological and medical use of immunological methods.</p> <p>The lecture “Molecular Biotechnology” deals with the molecular aspects of tumor development, production and use of recombinant antibodies and therapeutic molecules, gene therapy, the production of transgenic animals, and gives a brief insight into biotech companies.</p> <p>The lecture “Special Immunology” focuses on tumor immunology, the defense of viral, bacterial and parasitic</p>

	<p>infections, and vaccination. In addition, immune deficiencies and adverse reactions of the immune system such as allergies are discussed.</p> <p>The module also includes participation in the seminar “Immunotechnology” that deals with the preparation, modification and use of antibodies. Each participant will give a presentation of a research article.</p> <p>The practical part includes modern immunotechnological and biotechnological techniques such as FACS, ELISA, affinity chromatography, cell culture techniques, and recombinant antibodies.</p> <p><u>Objectives:</u></p> <p><u>1.) Expertise:</u> The module provides in-depth knowledge in the field of immunology and molecular biotechnology. Students will learn about the scientific way of thinking and experimental procedures of central methods such as gene therapy or protein engineering. The module covers the basics of modern antibody technologies and discusses the possibilities of the production and use of antibodies or other therapeutic agents.</p> <p><u>2.) Methods skills:</u> Students will learn about modern immunotechnological and biotechnological methods and will be able to apply concepts of the above mentioned subject areas for the solution of current immunological and biotechnological questions.</p> <p><u>3.) Decision-making and responsibility (socially relevant and strategic competences) :</u> Students can critically read a research article from the field of immunology and biotechnology and present and discuss it in front of the other participants using appropriate presentation media. Students can present the results of their experimental work in the form of a scientific paper.</p>			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture: Special Immunology and Immunotechnology	4		presentation (10 min)	
Lab course Immunotechnology or Biotechnology (6 weeks)	5			
Frequency of occurrence:	winter semester			
Prerequisite for participation in the module:	Basic knowledge of immunology and biotechnology is advantageous.			
Teaching unit:	Prof. Dr. Katja Arndt / Professor of Molecular Biotechnology			

BIO-B-RM9 Synthetic Biology	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Contents and objectives of the module:	<u>Content:</u> The module will impart comprehensive knowledge in the field of

		<p>synthetic biology. The lecture “Synthetic Biology” gives an overview about the development of synthetic biology, about current topics, the iGEM (international Genetically Engineered Machine) competition and encourages the development of new projects. During the seminar, students develop their own research project and write a research proposal that they will introduce to and discuss with the group (as presentation or poster). The practical part includes the planning and execution of a project within the field of synthetic biology. Modern methods of molecular biology, protein engineering, biochemistry and/or cell biology will be applied.</p> <p><u>Objectives</u></p> <p><u>1.) Expertise:</u> The module provides knowledge in the field of synthetic biology and familiarizes the students with modern issues of synthetic biology and the annual iGEM (International Genetically Engineered Machine) competition. The module provides a modular way of thinking about synthetic biology "parts - devices - system" and encourages the development of own projects.</p> <p><u>2.) Methodological competencies:</u> The students learn or improve their knowledge in the field of molecular biology, biochemistry, cellular biology and/or protein design. They develop their own project ideas and discuss them within the group. Furthermore, they will have the option to plan their own experimental work, which will be implemented in the laboratory in the practical part of the module. The practical part will deepen experimental skills in biochemistry, molecular biology, cellular biology and/or synthetic biology as well as working according to GLP. Students will learn to research literature.</p> <p><u>3.) Decision-making and responsibility (socially relevant and strategic competences) :</u> Students can critically read a research article from the field of synthetic biology and present and discuss it in front of the other participants using appropriate presentation media. Students will be able to present and defend a project idea. Students will be able to introduce results of their experimental work as a poster or scientific presentation.</p>		
Module (partial) exam(s) (number, form, scope):		Research proposal (5-10 pp.) with defence (approx. 15 min) Scientific presentation (20 min)		
Independent study time (in hours):		95		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and seminar	4		presentation (5-10 min)	
Lab course (6 weeks)	5			
Frequency of occurrence:		each summer semester		
Prerequisite for participation in the module:		Basic knowledge in one or more of the areas of molecular biology, biochemistry, cell biology, bioinformatics, biophysics or modeling is advantageous.		
Teaching unit:		Prof. Dr. Katja Arndt / Professor of Molecular Biotechnology		

BIO-B-RM10		Number of credit points (CP): 11		
Modern Methods in Light Microscopy				
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of mod-ule:	<p><u>Content:</u> Topics of this course are modern light-microscopic techniques as used in cell biology and physiology (e.g. confocal microscopy, live cell imaging, 3D microscopy, ion imaging), but also classical light-microscopic techniques (i.e. brightfield microscopy, darkfield microscopy, phase contrast microscopy, polarization microscopy, differential interference contrast microscopy). The lecture presents the microscopic hardware and methods the in theory. The seminar discloses possible applications and problems of selected microscopic techniques. In the practical course, the students will execute exemplary experiments in cell biology and cell physiology in order to train various microscopic techniques.</p> <p><u>Objectives:</u></p> <p><u>1.) Subject competencies:</u> The students will understand the theoretic fundamentals of the various light-microscopic techniques. They will know possible applications and the limits of the various light microscopic techniques, and they will be able to assess the suitability of microscopic techniques for addressing a scientific problem.</p> <p><u>2.) Methodological competencies:</u> The students are able to apply single-handedly various light microscopic techniques during research in life sciences. They can identify problems during application of these techniques, and provide and assess possible solutions.</p> <p><u>3.) Decision-making and responsibility (socially relevant and strategic competences) :</u> The students are able to work in a team. They can document and present scientific research in a proper manner. They are able to critically assess the applicability of a research technique. They can handle expensive, sensitive scientific equipment in a responsible manner.</p>			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
		Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
Courses (type of teaching)	Contact time (in semester hours)	For completing the module	For admission to the module exam	
Lecture and seminar: Modern Methods of Light Microscopy	4	presentation (30 min)		
Lab course Modern Methods of Light Microscopy (6 weeks)	5			
Offered:	each summer and winter semester			
Prerequisite for taking the module:				
Teaching unit:	Prof. Ralph Gräf, apl. Prof. Otto Baumann			

BIO-B-RM11	Number of credit points (LP): 11
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Physiology of Microorganisms	
Type of module (obligatory or facultative obligatory):	Facultative obligatory
Content and qualification goals of the module:	<p><u>Content:</u> The lecture Physiology of Microorganisms provides a comprehensive overview about the diversity of microbial life styles and its biochemical, physiological and molecular biological background. A special focus is given to the regulation of microbial activities and to the plethora of metabolic pathways featured by distinct bacterial groups in the different ecosystems. The lecture also includes cellular biology aspects of microorganisms.</p> <p>In the seminar, the students will present and scientifically discuss current microbial trends and problems using recent publications in the field (in English).</p> <p>The practical courses will provide basic and advanced experimental knowledge of microbiology. One course will be concerned with the adaptation of cyanobacteria to different environmental conditions and the specific role of secondary metabolites in the process using molecular biological, biochemical, and chemical analytical and microscopic techniques. . An alternative practical course will focus on microorganisms in extreme habitats and their specific role in carbon cycles using physiological, microscopic and molecular biological techniques.</p> <p><u>Qualification goals:</u></p> <p><u>1.) Expertises</u></p> <ul style="list-style-type: none"> - The students gain a basic knowledge about different microbial life styles and the diversity of biochemical pathways in microorganisms - The students gain advanced knowledge about phototrophic bacteria and extremophilic microorganisms. - The students can reflect interconnections between the different microbial subdisciplines. - The student can argue and render a judgement about current microbial problems <p><u>2.) Methodological skills:</u></p> <ul style="list-style-type: none"> - The students are able to independently plan and conduct physiological and molecular biological experiments on microorganisms - The students can present and scientifically discuss original literature related to the physiology of microorganisms - The students are able to deduce original scientific questions related to the physiology of microorganisms and to suggest appropriate techniques to approach these problems. <p><u>3.) Strategic skills:</u></p> <ul style="list-style-type: none"> - The student can describe their experimental work in a written protocol and discuss it related to the scientific context. - The students can present and defend original literature in front of a public audience using appropriate media tools. - The students are able to work in a team and to jointly collaborate on a given scientific question
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Written exam (90 min)
Time for self-learning (in total hours (h)):	95

Activities (Teaching forms)	Contact time (in SWS)	Additional requirements (number, type, extent)		Module exams (number, type, extent)
		For completion of the module	For admission to the exam	
Lecture and seminar Physiology of Microorganisms	4		presentation (30 min)	
Lab course (6 weeks) Physiology of phototrophic bacteria/Physiology of extremophilic bacteria	5			
Frequency of the module: winter semester				
Preconditions for participation				
Responsible Teaching Unit: Prof. Dr. Elke Dittmann/Microbiology, Dr. Susanne Liebner (GFZ), Dr. Jan-Christoph Kehr				

BIO-B-RM12	Number of credit points (CP): 11
Current aspects and methods of plant cell biology	
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p>The lecture will focus on current research and methods in the cell biological analysis of plant growth and development. The topics discussed will be cellular and sub-cellular functions of plant hormone biosynthesis, transport and response pathways, membrane trafficking and recycling pathways, protein degradation pathways, control of cytoskeletal organisation and cell wall organisation during cell division, cell elongation, cell and tissue polarity establishment. Furthermore relationships between epidermal patterning/cell-fate specification pathways, cell division, cell and tissue polarity establishment will be discussed as well as inter- and intracellular communication during tissue polarity establishment.</p> <p>The practical work will involve the cell biological and physiological analysis of plant cell division, elongation, cell and tissue polarity. It will be oriented along current research questions addressed in the Grebe group. Methods to be used will among others include live imaging of cytoskeletal elements, cell division and cell polarity by employing fluorescent proteins and confocal laser scanning microscopy, fluorescence recovery after photobleaching and immunofluorescence localization methods. Interaction of visualized proteins will be analysed by protein-protein interaction methods and will be verified <i>in vivo</i> by phenotypic cell biological analysis of single and double mutants.</p> <p>The seminar will discuss in detail original scientific articles about current topics in plant cell and developmental cell biology.</p> <p>As such, the module will provide students with a basic understanding of current research questions and methods in plant cell biology. The students will be familiarized with the theoretical background, scientific approach and experimental methods in plant cell and developmental cell biology. The module will teach students specialized knowledge and capabilities in the cell biological analysis of biological processes; as such it forms a central part of the Masters course when intending to specialize on</p>

	genetics, molecular and cellular biology.			
	<p>In particular:</p> <ul style="list-style-type: none"> - students will learn how to read and critically evaluate original scientific literature in English. - students will learn how to extract the essential points from original scientific literature. - students can discuss scientific questions in writing in a concise manner. - students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
“Current aspects and methods of plant cell biology” (Lecture and seminar)	4		presentation (30 min)	
Lab course “Current aspects and methods of plant cell biology” (6 weeks)	5			
Offered:		Summer- und Winter semester		
Prerequisite for taking the module:				
Teaching unit:		AG Grebe		

BIO-B-RM13	Number of credit points (CP): 11
Evolutionary and population genetics	
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p>The lecture will focus on fundamental as well as current research questions and experimental approaches in evolutionary and population genetic analysis with an emphasis on empirical studies, especially on vertebrates. It will include studies on the genetic basis of evolutionary adaptations as well as discussions about the causes and evolutionary effects of demographic changes including populations size changes, population separation and gene flow among populations.</p> <p>The practical work will involve DNA sequencing and/or SNP typing of vertebrate sample sets and will be guided by current research questions that are being addressed in the Hofreiter group. Methods to be used will include DNA extraction, PCR, SNP typing, next generation sequencing library construction, DNA hybridization capture, etc.</p> <p>The seminar will discuss in detail original scientific articles about current topics in evolutionary and population genetics.</p> <p>As such, the module will provide students with a basic understanding of current research questions and methods in evolutionary and population genetics. The students will be familiarized with the theoretical background, scientific approach and experimental methods in evolutionary and population</p>

	<p>genetics. The module will teach students specialized knowledge and capabilities in the evolutionary and population genetic analysis of biological processes; as such it forms a central part of the Masters course when intending to specialize on genetics, molecular and cellular biology.</p> <p>In particular:</p> <ul style="list-style-type: none"> - students will learn how to read and critically evaluate original scientific literature in English. - students will learn how to extract the essential points from original scientific literature. - students can discuss scientific questions in writing in a concise manner. - students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
“Evolutionary and Population Genetics” (Lecture and seminar)	4		presentation (30 min)	
Lab course “Evolutionary and Population Genetics” (6 weeks)	5			
Offered:		Winter semester		
Prerequisite for taking the module:				
Teaching unit:		AGs Hofreiter		

BIO-B-RM14		Number of credit points (CP): 11
Physical Methods in Live Cell Imaging		
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> The aim of this course is to illustrate the application of mathematical methods (e.g. fluctuation analysis, signal correlation) in the context of quantitative fluorescence microscopy of biological molecules in living cells. Such cutting-edge methods are capable of providing precise information about protein-protein interaction in complex biological systems. The lecture covers the most modern approaches in the field of quantitative fluorescence microscopy including single molecule approaches (e.g. single molecule FRET, tracking), image correlation methods (e.g. k-space microscopy) as well as super-resolution microscopy (e.g. STED, STORM). A special aim is set on introducing computer programming methods related to the analysis of imaging data (e.g. Monte Carlo simulations, Fast-Fourier transformation for correlation analysis) using Matlab. The laboratory classes will provide the chance to deepen the practical knowledge of the students in a selection of the above mentioned microscopy and programming techniques.</p> <p><u>Objectives:</u></p>	

	<p>The students will actively participate in the seminars with one presentation, which will foster their ability to critically read and present scientific literature.</p> <p>In the experimental courses the students will learn to apply various quantitative microscopy methods to study protein dynamics and protein-protein interactions directly in cells.</p> <p>The experimental part is carried out as a small, independent research projects, which allows developing skills to independently design and plan scientific experiments and to work in a team.</p>			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture Seminar	4		presentation (15 min)	
Lab course (6 weeks)	5			
Offered:	Summer semester			
Prerequisite for taking the module:				
Teaching unit:	Prof. Dr. Salvatore Chiantia			

BIO-B-RM15 Metalloproteins	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p><u>Content:</u> The course deals with metalloenzymes, their biosynthesis, mechanism of action (catalysis) and protein structure. Main parts of the lecture are general principles of the synthesis of complex metallo-cofactors, the role of the metal in these cofactors, and their relevance in the human body including associated diseases and therapies.</p> <p>In the practical part the students will learn the purification and characterization of metall-containing proteins. The purified proteins will be characterized by spectroscopic methods, enzyme kinetics, protein-protein interactions (BLI, ITC, SPR) and metal analyses (ICP-OES). In addition, metal-containing cofactors will be synthesized in vitro and inserted into the apo-protein.</p> <p>The seminar deals with original literature to the topics in the lecture, which will be presented by each student and critically discussed. In addition a poster will be prepared by a group of students including a poster presentation in front of an audience.</p> <p><u>Objectives:</u> <u>1.) Subject competencies:</u> The modul deals with basics of metal-containing proteins, the role of the metal, enzyme kinetics and protein biochemistry. The students are expected to learn how to solve scientific questions and how to approach them. The students will be familiarized with</p>

	<p>the theoretical background, scientific approach and experimental methods in the studies of metalloenzymes which comprise 30% of all proteins. The module will teach students specialized knowledge and capabilities in the analysis of biological and biochemical processes; as such it forms a central part of the Masters course when intending to specialize on biochemistry.</p> <p><u>2.) Methodological competencies:</u></p> <ul style="list-style-type: none"> - Students will learn how to read and critically evaluate original scientific literature in English. - Students will learn how to extract the essential points from original scientific literature. <p><u>3.) Performance competencies:</u></p> <ul style="list-style-type: none"> - Students can discuss scientific questions in writing in a concise manner. - Students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - Students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and seminar: Proteinanalytics and Metalloproteine	4			
Lab course (6 weeks) Proteinanalytik	5			
Offered:	Summer semester			
Prerequisite for taking the module:				
Teaching unit:	Prof. Dr. Silke Leimkühler			

BIO-B-RM16	Number of credit points (CP): 11
Current Aspects of Molecular Plant Physiology	
Module type (mandatory or elective module):	Depends on course of study
Content and objective of module:	<p><u>Content:</u></p> <p>The lecture will focus on current research questions and experimental approaches in plant physiology and plant cell biology, such as metabolite fluxes, photosynthesis, cell wall formation, cytoplasm genetics, host-symbiont interactions, abiotic stress tolerance and cellular signalling. The practical work will be guided by current research questions that are being addressed at the MPIMP, Potsdam/Golm. Methods to be used will include besides basic physiological and molecular biology methods, qRT-PCR, GC/MS, LC/MS, FTIR and fluorescence spectroscopy. The seminar will discuss in detail original scientific articles about current topics in plant physiology and plant cell biology.</p>

	<p><u>Objectives:</u></p> <p><u>1.) Subject competencies:</u> The module will provide students with a basic understanding of current methods and challenges in modern plant physiology and plant cell biology. The students will be familiarized with the theoretical background, scientific approach and experimental methods. Current research questions will be addressed, with a specialized focus on OMICS and high-throughput technologies.</p> <p><u>2.) Methodological competencies:</u></p> <ul style="list-style-type: none"> - Students will learn how to read and critically evaluate original scientific literature in English. - Students will learn how to extract the essential points from original scientific literature. <p><u>3.) Performance competencies:</u></p> <ul style="list-style-type: none"> - Students can discuss scientific questions in writing in a concise manner - Students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - Students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and seminar: Current Aspects of Plant Physiology and Plant Cell Biology	4		Presentation (30 in)	
Lab course (6 weeks) Current Aspects of Plant Physiology and Plant Cell Biology	5			
Offered:	Winter semester			
Prerequisite for taking the module:				
Teaching unit:	Prof. Dr. Michael Lenhard / Prof. Dr. Bernd Müller-Röber			

BIO-B-RM17 Current Problems and Modern Methods in Plant Genetics and Epigenetics	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Content and objective of module:	<p><u>Content:</u> The lecture will focus on current research questions and experimental approaches in the genetic analysis of plant growth and development, such as meristem function, stem cells, control of meristem and organ identity, control of flowering time, regulation of organ and tissue growth, patterning, cellular differentiation, etc. It will also include a discussion of aspects of plant epigenetics.</p>

		<p>The practical work will involve the genetic analysis of plant organ growth and long-term stress adaptation and will be guided by current research questions that are being addressed in the Bärle and Lenhard groups. Methods to be used will include genetic mapping using molecular markers, molecular cloning, expression analysis using reporter genes and/or RT-PCR, clonal analysis, etc.</p> <p>The seminar will discuss in detail original scientific articles about current topics in plant genetics and epigenetics.</p> <p><u>Objectives:</u> As such, the module will provide students with a basic understanding of current research questions and methods in plant genetics and epigenetics with a focus on development. The students will be familiarized with the theoretical background, scientific approach and experimental methods in plant genetics and epigenetics. The module will teach students specialized knowledge and capabilities in the genetic analysis of biological processes; as such it forms a central part of the Masters course when intending to specialize on genetics, molecular and cellular biology.</p> <p><u>In particular:</u></p> <ul style="list-style-type: none"> - students will learn how to read and critically evaluate original scientific literature in English. - students will learn how to extract the essential points from original scientific literature. - students can discuss scientific questions in writing in a concise manner. - students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 		
Module (partial) exam(s) (number, form, scope):		Log (approx. 20 pp.) Oral exam (30 min)		
Independent study time (in hours):		95		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture and seminar “Current Problems and Modern Methods in Plant Genetics and Epigenetics”	4		Presentation (30 min)	
Lab course (6 weeks) “Current Problems and Modern Methods in Plant Genetics and Epigenetics”	5			
Offered:		Winter semester		
Prerequisite for taking the module:				
Teaching unit:		AG Genetik und AG Epigenetik der Pflanzen		

BIO-B-RM18 Microevolution/Conserving the Evolutionary Process (<i>Evolution across Scales</i> module C)	Number of credit points (CP): 11
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Module type (mandatory or elective module):	Depends on course of study			
Content and objective of mod-ule:	<p>Content: Basic principles of conservation biology and genetics will be taught in an evolutionary framework, including genetic aspects such as inbreeding and drift vs. selection and adaptation. The concept of preserving "the evolutionary process" acting in taxa and ecosystems will be covered and discussed.</p> <p>Objectives:</p> <p>1.) Subject competencies Improvement of fundamental knowledge of microevolution and species conservation, including the use of molecular markers and population genetically data analysis.</p> <p>2.) Methodological competencies Students can apply molecular techniques (such as DNA/RNA isolation, PCR, gel electrophoresis, and cloning) as well as data analyses with several programs. Training in current topics based on publications.</p> <p>3.) Performance competencies Training in presentations of current topics and processing of self-made questions and results. Students are working in a team and could present results according to scientific standards orally and in writing.</p>			
Module (partial) exam(s) (number, form, scope):	Oral exam (15 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Modulprüfung (Anzahl, Form, Umfang)
		For completing the module	For admission to the module exam	
Lecture: Conservation Genetics	2		written exam (90 min)	
Exercise: Molecular population genetics/Conservation genetics	5		protocol	
Seminar: How much conservation is needed in evolution?	2		presentation (15 min)	
Offered:	each summer and winter semester			
Prerequisite for taking the module:	-			
Teaching unit:	Prof. Dr. Ralph Tiedemann, Evolutionsbiologie/Spezielle Zoologie			

BIO-B-RM19 The Central Role of Evolutionary Biology in Biosciences (<i>Evolution across Scale module A</i>)	Number of credit points (CP): 11
Module type (mandatory or elective module):	Depends on course of study
Content and objective of mod-ule:	<p>Content: „Nothing makes sense in biology except in the light of evolution": This module aims at evaluating Dobzhansky's famous phrase by (1) a joint lecture series where different biological disciplines are discussed in the light of evolution, (2) a lecture series dealing with the major disputes/syntheses in evolutionary</p>

	biology (Lamarckism vs. Darwinism, epigenetics, the modern synthesis, genotypic vs. phenotypic evolution) and a complementary seminar. Objectives: 1.) Subject competencies Improvement of fundamental knowledge and concepts of evolutionary biology based on current examples 2.) Methodological competencies Training in current topics based on publications 3.) Performance competencies Training in presentations in current topics			
Module (partial) exam(s) (number, form, scope):	Oral exam (15 min) Term paper (approx. 15 pp.)			
Independent study time (in hours):	240			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Modulprüfung (Anzahl, Form, Umfang)
		For completing the module	For admission to the module exam	
Lecture 1: State-of-the-art Evolutionary Biology	2			
Lecture 2: Nothing in biology makes sense, except in the light of evolution	1			
Seminar: Integrative function of Evolutionary Biology	1		presentation (15 min)	
Oberseminar 1: Seminar Series	1		Active participation at the discussion	
Oberseminar 2: Seminar Series	1		Active participation at the discussion	
Offered:	each summer and winter semester			
Prerequisite for taking the module:	-			
Teaching unit:	Prof. Dr. Ralph Tiedemann, Evolutionsbiologie/Spezielle Zoologie			

BIO-B-RM20	Credit points (CP): 11
Neurobiology	
Module type (mandatory or elective module):	Depends on course of study
Content and goals:	<u>Content:</u> The course will cover the structure and function of the mammalian auditory system. The lecture teaches basic and advanced knowledge on anatomy and physiology of the cochlea and the central auditory system. It illustrates mechanisms of sensory transduction, principles of spectral and temporal processing, monaural and binaural information processing by central auditory nuclei up to the auditory cortex. In the seminar, students present and discuss original research articles from the field of auditory neuroscience. The practical work includes neuroanatomical and neurophysiological investigations of the mouse auditory system (histology and immunocytochemistry; light microscopic techniques, morphometry and image analysis,

- gain hands-on experience on techniques of molecular biology, genomics and experimental systems biology;
- learn how different techniques from these areas can be combined efficiently for exploring new scientific questions;
- can develop experimental strategies to approach a scientific question using molecular-biological and genomics techniques.

3.) Capacity building (socially relevant and strategic skills)

Students gain the capacity ...

- to present their research using appropriate media;
- to work in a team and jointly address a scientific problem in the field of molecular and genome-oriented biology;
- to plan experiments effectively and to manage time and resources autonomously in a defined time window;
- to self-organize, which enables the parallel realization of experiments;
- to design (small) research projects independently and to assess the consistency of the approaches used;
- to independently and timely to establish experimental protocols.

The module provides guidance to students in molecular biology, genomics and experimental systems biology at the Science Campus Golm.

The **lecture** provides a broader overview of the fields of modern molecular biology, genomics research and experimental systems biology. It particularly focuses on “omics” technologies and their underlying principles, advantages, limitations and application areas. Topics include: Next Generation Sequencing, ChIP-seq, RNA-Seq, multi-parallel qRT-PCR, high-throughput methods for the analysis of protein-protein interactions, directed and random mutagenesis, biochip technologies, SPOT method, SELEX, phage display, genome editing methods (e.g. ZFNs, TALENs, CRISPR-Cas9). Newly established omics technologies may be included if relevant.

The **literature seminar** focuses on current aspects of modern molecular biology research, genomics and experimental systems biology and presents and discusses recent publications from these fields (with an emphasis on plant biology). The focus is on data collection and their evaluation as well as the appraisal of the research results for future experiments.

As part of the 6-week **research internship** and on the basis of selected research problems students learn how to use various types of experimental methods from the fields of molecular biology, genomics and experimental systems biology. Students will perform research-driven experiments in the laboratory, document the results obtained in the form of laboratory protocols, and concisely summarize the research question, the chosen methodological approaches and the results obtained in written form. Plants and prokaryotic and eukaryotic microbes are the preferred model organisms. In conjunction with the lecture and the literature seminar, the students will learn to assess their own experimental

	approaches in the light of alternative methods.			
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Written exam (90 min)			
Independent study time (in hours):	95			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Moduleil-prüfung (Anzahl, Form, Umfang)
		For completing the module	Für die Zulassung zur Modulprüfung	
Lecture: New technologies in Genomics Research	2	-	-	
Literature Seminar: Plant Genomics and Systems Biology	2	presentation (20 min)	-	
Lab course (6 weeks)	5	-	-	
Offered:	Winter Semester			
Prerequisite for taking the module:	-			
Teaching unit:	Department Molecular Biology (Prof. Müller-Röber)			

BIO-B-RM22		Credit points (CP): 11	
Current Research in Biochemistry and Molecular Biology in Local Research Institutes and Biotechnology Companies			
Module type (Pflicht- oder Depends on course of study):	Depends on course of study		
Content and goals:	<p>The module aims to familiarize students with current research in the area of Biochemistry and Molecular Biology. To this end, students have to attend the lecture and the seminar from one of the list of WPM, and in addition do a 6-week practical course in a local research institute or biotechnology company in the Potsdam/Berlin area.</p> <p>As a result,</p> <ul style="list-style-type: none"> • Students will learn how to read and critically evaluate original scientific literature in English. • Students will learn how to extract the essential points from original scientific literature. • Students will learn how to evaluate and present and document scientific data. • Students can present their work to a scientific audience using appropriate methods and deal with questions and/or comments in a scientific discussion about their topic. • Students can ask concise, to-the-point questions about possible future research directions to follow up a given problem. 		
Module (partial) exam(s) (number, form, scope):	Log (approx. 20 pp.) Oral exam (30 min)		
Selbstlernzeit (in Zeitstunden (h)):	95		
courses	Contact time (in SWH)	Supplementary exam work (Number, form, scope)	Module (partial) exam(s) (Number, form, scope)

		For completing the module	For admission to the module exam	
Lecture and seminar	4		Presentation (20 min)	
Lab course (6 weeks)	5			
Offered:				
		each summer and winter semester		
Pre-requisites:				
		-		
Module convenor				
		Prof. Dr. Michael Lenhard		

BIO-B-RM23		Number of credit points (CP): 11
Immunology and Immunotechnology		
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u></p> <p>The module serves to deepen immunological and biotechnological knowledge. Particular emphasis is given to biotechnological and medical use of immunological methods.</p> <p>The lecture “Immunology I” comprises characteristics of the innate and adaptive immune response; organs, cells and molecules of the immune system; mechanisms of the immune defense; genetic and molecular aspects of antibody and T-cell receptor variability; evolution of the adaptive immune defense and regulation of the immune response.</p> <p>The lecture “Special Immunology” focuses on tumor immunology, the defense of viral, bacterial and parasitic infections, and vaccination. In addition, immune deficiencies and adverse reactions of the immune system such as allergies are discussed.</p> <p>The lecture “Molecular Biotechnology” deals with the molecular aspects of tumor development, production and use of recombinant antibodies and therapeutic molecules, gene therapy, the production of transgenic animals, and gives a brief insight into biotech companies.</p> <p>The module also includes participation in the seminar “Immunotechnology” that deals with the preparation, modification and use of antibodies. Each participant will give a presentation of a research article.</p> <p>The practical part includes modern immunotechnological and biotechnological techniques such as FACS, ELISA, affinity chromatography, cell culture techniques, and recombinant antibodies.</p> <p><u>Objectives:</u></p> <p><u>1.) Subject competencies:</u></p> <p>The module provides in-depth knowledge in the field of immunology and molecular biotechnology. Students will learn about the scientific way of thinking and experimental procedures of central methods such as gene therapy or protein engineering. The module covers the basics of modern antibody technologies and discusses the possibilities of the production and use of antibodies or other therapeutic agents.</p> <p><u>2.) Methodological competencies:</u></p>	

	<p>Students will learn about modern immunotechnological and biotechnological methods and will be able to apply concepts of the above mentioned subject areas for the solution of current immunological and biotechnological questions. Students will learn how to extract the essential points from original scientific literature.</p> <p><u>3.) Performance competencies:</u> Students can critically read a research article from the field of immunology and biotechnology and present and discuss it in front of the other participants using appropriate presentation media. Students can present the results of their experimental work in the form of a scientific paper.</p>			
Module (partial) exam(s) (number, form, scope):	Oral exam (30 min)			
Independent study time (in hours):	180			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lecture Special Immunology	2			
Lecture Biotechnology II	2			
Lecture Immunology I	2			
Seminar Immunotechnology	1		Presentation (approx. 10 min); active participation at the discussion	
Lab course Immunotechnology or FACS (DRFZ)	3		Log (approx. 10 pp.)	
Offered:	Annually (V Immunology Summer semester; V Special Immunology and Molecular Biotechnology Winter semester; Seminar Summer und Winter semester; lab course during the semester break)			
Prerequisite for taking the module:				
Teaching unit:	Prof. Dr. Katja Arndt / Professur für Molekulare Biotechnologie			

BIO-B-VM	Number of credit points (CP): 7
Advanced Research Practical	
Module type (mandatory or elective module):	Depends on course of study
Content and objective of module:	<p>General introduction into scientific research and the scientific method; literature research; preparatory experiments for the Master thesis. The main objective of this module is to prepare students for their Master thesis via practical work in the laboratory, training in specialized methods and theoretical preparation by literature research. This will allow students to successfully and efficiently work on their Master thesis with minimal delay.</p> <p>In particular:</p> <ul style="list-style-type: none"> - students will learn how to read and critically evaluate original scientific literature in English. - students will learn how to extract the essential points from

	original scientific literature. - students will learn how to plan experiments and analyze results. As a result: - students can discuss scientific questions in writing in a concise manner. - students can present their work to a scientific audience using appropriate media and deal with questions and/or comments in a scientific discussion about their topic. - students can ask concise, to-the-point questions about possible future research directions to follow up a given problem.			
Module (partial) exam(s) (number, form, scope):	Research report for the master thesis (1 page)			
Independent study time (in hours):	50			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Lab course (4 weeks)	4			
Offered:	Each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Prof. Dr. Michael Lenhard			

The translation of the modules BIO-B-WM1 till BIO-B-WM12 will follow soon.

BIO-B-WM1: Biochemistry A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	

Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der biochemischen Analyse von biologischen Prozessen, wie Zellbiochemie, metallhaltige Proteine, Protein-Protein- und Protein-Lipid-Wechselwirkungen und Antikörperproduktion und -verwendungen etc. im Mittelpunkt. Es werden angewandten Aspekte der modernen Biochemie diskutiert.</p> <p>Die praktische Arbeit wird die biochemische Analyse der verschiedenen Prozesse beinhalten und wird von aktuellen Forschungsfragen geleitet, die in den jeweiligen Arbeitsgruppen, die das Praktikum organisieren, angesprochen werden. Die verwendeten Methoden schließen Proteinexpressionen und -reinigung, Charakterisierung von Proteinen mittels spektroskopischer Methoden, Messungen der Enzymkinetik, Protein-Protein-Wechselwirkungen (BLI, ITC, SPR), die Proteinstabilität und Proteinkonformation oder -struktur usw. ein.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u> Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Methoden in der Biochemie mit einem Schwerpunkt auf der Grundlagenforschung schaffen. Die Studierenden werden mit den theoretischen Grundlagen, wissenschaftlichen Ansätzen und experimentellen Methoden in der aktuellen biochemischen Forschung vertraut gemacht; sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der biochemischen Analyse von biologischen Prozessen vermitteln; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 		
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)		
Independent study time (in hours):	120		
	Contact time (in semester	Supplementary exam work (Number, form, scope)	Module (partial) exam(s) (Number,

Courses (type of teaching)	hours)	For completing the module	For admission to the module exam	form, scope)
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)	-	-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			

BIO-B-WM2: Biotechnology A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Biotechnologie, wie z. B. Antikörperproduktion und -verwendungen, Proteinexpression und -reinigung, Nanotechnologie, Biosensoren, neuartige Klonierungstechnologien usw. im Mittelpunkt.</p> <p>Die praktische Arbeit wird sich auf Problembeispiele und relevante Methoden für die moderne Biotechnologie konzentrieren und wird von aktuellen Forschungsfragen geleitet, die in den jeweiligen das Praktikum organisierenden Arbeitsgruppen angesprochen werden. Es werden Methoden wie In-Vitro-Proteinexpression und -Reinigung, Charakterisierung von Antikörpern und Proteinen unter Verwendung spektroskopischer Methoden, Messungen von Protein-Protein-Wechselwirkungen (BLI, ITC, SPR), Proteininstabilität und Proteinkonformation oder -Struktur, die Verwendung von Biosensoren usw. gelehrt.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Verfahren in der Biotechnologie mit Schwerpunkt auf aktuelle Forschungsprobleme schaffen. Diese Aspekte sollen durch Gruppen an der Universität Potsdam und Biotechnologieunternehmen im Gebiet Berlin-Potsdam angesprochen werden. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentellen Methoden in der aktuellen Biotechnologie, sowie die rechtlichen und gesellschaftlichen Aspekte vertraut gemacht; sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten bei der Suche nach biotechnologischen Lösungen der bestehenden Probleme lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 	
Module (partial) exam(s) (number, form, scope):	<p>An examination in one of the following forms:</p> <p>Written exam, (90 min)</p> <p>Oral exam, (30 min)</p>	

Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)		-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			

BIO-B-WM3: Protein Science A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in Proteinwissenschaften, wie In-vitro-Protein-Expression, Aufreinigung, funktionelle Charakterisierung, Strukturbestimmung und Anwendung in biotechnologischen Kontexten usw. im Mittelpunkt. Es werden angewandte Aspekte der modernen Biochemie diskutiert.</p> <p>Die praktische Arbeit wird die biochemische Analyse von Proteinen beinhalten und wird von aktuellen Forschungsfragen geleitet, die in den jeweiligen das Praktikum organisierenden Arbeitsgruppen angesprochen werden.</p> <p>Es werden Methoden zu In-Vitro-Protein-Expression und Reinigung aus prokaryotischen und eukaryotischen Zellen, die Charakterisierung von Proteinen mittels spektroskopischer Methoden, Messungen von Protein-Protein-Wechselwirkungen (BLI, ITC, SPR), die Proteinstabilität und Proteinkonformation oder Struktur gelehrt. Das Design von Proteinen einschließlich bindender Liganden ist von Interesse.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p>Objectives:</p> <p>Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Methoden der Proteinwissenschaften mit Schwerpunkt auf strukturelle und funktionelle Charakterisierung vermitteln. Die Studierenden sollen die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden der aktuellen biochemischen Analyse von Proteinen vertraut gemacht werden. Sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der Proteinwissenschaft lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 	
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)	
Independent study time (in hours):	120	

Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)	-	-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:		each semester		
Prerequisite for taking the module:		-		
Teaching unit:		Biology / Biochemistry		

BIO-B-WM4: Genome Research and Systems Biology A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Genomik und Systembiologie, wie z. B. Genomstruktur und Evolution, Transkriptomik, Proteomik und Metabolomik, Hochdurchsatz-Analyse und Screening, Bildgebung und Bildanalyse, Bioinformatik und mathematische Modellierung biologischer Prozesse usw. im Mittelpunkt. Es werden evolutionäre und angewandte Aspekte der Genomik und Systembiologie in Bezug auf menschliche Krankheiten und Pflanzenzüchtung diskutiert. Die praktische Arbeit wird die genomische und systembiologische Analyse von biologischen Prozessen beinhalten und wird von aktuellen Forschungsfragen geleitet, die in den entsprechenden das Praktikum organisierenden Arbeitsgruppen angesprochen werden. Die praktische Arbeit schließt Methoden zu molekularer Klonierung, Expressions-Analyse unter Verwendung von Reportergenen und/ oder RT-PCR, die Analyse der „nächsten Generation“-Sequenzierung oder Microarray-Daten, Bildanalyse, Stoffwechselfmessungen usw. ein.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Genomik und Systembiologie mit Schwerpunkt auf genetischen Modellsystemen verschaffen. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Genomik und Systembiologie vertraut gemacht. Sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der genomischen und systembiologische Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 	
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)	
Independent study time (in hours):	120	

Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)	-	-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:		each semester		
Prerequisite for taking the module:		-		
Teaching unit:		Biology / Biochemistry		

BIO-B-WM5: Molecular Biology A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Molekularbiologie, wie zum Beispiel Genomstruktur und Evolution, Transcriptomics, Hochdurchsatzanalyse, neuartige Klonierungstechniken, Funktionsanalyse von Genen und Proteinen, Bioinformatik usw. im Mittelpunkt. Es werden angewandte Aspekte der Molekularbiologie, besonders für menschliche Krankheiten und Pflanzenzüchtung, diskutiert.</p> <p>Die praktische Arbeit wird die molekularbiologische Analyse von biologischen Prozessen beinhalten und wird von aktuellen Forschungsfragen geleitet, die in den entsprechenden das Praktikum organisierenden Arbeitsgruppen angesprochen werden. Es werden umfassende Methoden zur molekularen Klonierung, Expression Analyse unter Verwendung von Reportergenen und/oder RT-PCR, Protein-Interaktion-Screens und Protein-Expression in Hefe etc. gelehrt.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Molekularbiologie mit Schwerpunkt auf genetischen Modellsystemen schaffen. Die Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Molekularbiologie vertraut gemacht. Sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der molekularbiologischen Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigen wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 	
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)	
Independent study time (in hours):	120	

Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)	-	-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:		each semester		
Prerequisite for taking the module:		-		
Teaching unit:		Biology / Biochemistry		

BIO-B-WM6: Cellular and Developmental Biology A		Anzahl der Leistungspunkte (LP): 8
Module type (mandatory or elective module):	Depends on course of study	
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der genetischen und molekularen Analyse der Zellbiologie und Entwicklung, wie beispielsweise die Zelldifferenzierung, Stammzellenbiologie, Musterbildung, Zellzykluskontrolle, Zellbeweglichkeit, die Regulierung des Organ- und Gewebewachstums, Morphogenese, Zelldifferenzierung etc. im Mittelpunkt. Es werden übergreifende Aspekte der Zell- und Entwicklungsbiologie, insbesondere hinsichtlich menschlicher Krankheiten und Pflanzenzüchtung diskutiert.</p> <p>Die praktische Arbeit wird die genetische, molekulare und zellbiologische Analyse von Wachstum und Entwicklung beinhalten und wird von aktuellen Forschungsfragen geleitet, die in den entsprechenden das Praktikum organisierenden Arbeitsgruppen angesprochen werden. Es werden Methoden zur Licht- und Fluoreszenzmikroskopie, Antikörperfärbung, Molekulare Klonierung, Expression Analyse unter Verwendung von Reportergenen und/oder RT-PCR, klonale Analyse usw. gelehrt.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u> Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Zell- und Entwicklungsbiologie mit Schwerpunkt auf genetischen Modellsystemen schaffen. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Zell- und Entwicklungsbiologie vertraut gemacht. Sie sollen praktische Erfahrungen bei der Anwendung dieser Verfahren gewinnen. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der molekularbiologischen Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 	

Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Praktikum (2 Wochen) (Praktikum)	4	Log (15 pp.)	-	-
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			

BIO-B-WM7: Biochemistry B	Anzahl der Leistungspunkte (LP): 6
Module type (mandatory or elective module):	Depends on course of study

Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der biochemischen Analyse von biologischen Prozessen, wie Zellbiochemie, metallhaltige Proteine, Protein-Protein- und Protein-Lipid-Wechselwirkungen und Antikörperproduktion und -verwendungen etc. im Mittelpunkt. Es werden angewandten Aspekte der modernen Biochemie diskutiert.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u> Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Methoden in der Biochemie mit einem Schwerpunkt auf der Grundlagenforschung schaffen. Die Studierenden werden mit den theoretischen Grundlagen, wissenschaftlichen Ansätzen und experimentellen Methoden in der aktuellen biochemischen Forschung vertraut gemacht. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der biochemischen Analyse von biologischen Prozessen vermitteln; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 			
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			

BIO-B-WM8: Biotechnology B		Anzahl der Leistungspunkte (LP): 6		
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Biotechnologie, wie z. B. Antikörperproduktion und -verwendungen, Proteinexpression und -reinigung, Nanotechnologie, Biosensoren, neuartige Klonierungstechnologien usw. im Mittelpunkt.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Verfahren in der Biotechnologie mit Schwerpunkt auf aktuelle Forschungsprobleme schaffen. Diese Aspekte sollen durch Gruppen an der Universität Potsdam und Biotechnologieunternehmen im Gebiet Berlin-Potsdam angesprochen werden. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentellen Methoden in der aktuellen Biotechnologie, sowie die rechtlichen und gesellschaftlichen Aspekte vertraut gemacht. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten bei der Suche nach biotechnologischen Lösungen der bestehenden Probleme lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. - Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. • 			
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			

Teaching unit:		Biology / Biochemistry		
BIO-B-WM9: Protein Science B				Anzahl der Leistungspunkte (LP): 6
Module type (mandatory or elective module):		Depends on course of study		
Content and objective of module:		<p>Content:</p> <p>Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in Proteinwissenschaften, wie In-vitro-Protein-Expression, Aufreinigung, funktionelle Charakterisierung, Strukturbestimmung und Anwendung in biotechnologischen Kontexten usw. im Mittelpunkt. Es werden angewandte Aspekte der modernen Biochemie diskutiert.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p>Objectives:</p> <p>Das Modul wird den Studierenden ein detailliertes Verständnis der aktuellen Forschungsfragen und Methoden der Proteinwissenschaften mit Schwerpunkt auf strukturelle und funktionelle Charakterisierung vermitteln. Die Studierenden sollen die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden der aktuellen biochemischen Analyse von Proteinen vertraut gemacht werden. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der Proteinwissenschaft lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Biochemie, Proteinwissenschaften oder Biotechnologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. • Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 		
Module (partial) exam(s) (number, form, scope):		An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)		
Independent study time (in hours):		120		
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	

Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			

BIO-B-WM10: Genome Research and Systems Biology B			Anzahl der Leistungspunkte (LP): 6	
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Genomik und Systembiologie, wie z. B. Genomstruktur und Evolution, Transkriptomik, Proteomik und Metabolomik, Hochdurchsatz-Analyse und Screening, Bildgebung und Bildanalyse, Bioinformatik und mathematische Modellierung biologischer Prozesse usw. im Mittelpunkt. Es werden evolutionäre und angewandte Aspekte der Genomik und Systembiologie in Bezug auf menschliche Krankheiten und Pflanzenzüchtung diskutiert.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Genomik und Systembiologie mit Schwerpunkt auf genetischen Modellsystemen verschaffen. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Genomik und Systembiologie vertraut gemacht. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der genomischen und systembiologische Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. • Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 			
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-

Offered:	each semester
Prerequisite for taking the module:	-
Teaching unit:	Biology / Biochemistry

BIO-B-WM11: Molecular Biology B		Anzahl der Leistungspunkte (LP): 6		
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der Molekularbiologie, wie zum Beispiel Genomstruktur und Evolution, Transcriptomics, Hochdurchsatzanalyse, neuartige Klonierungstechniken, Funktionsanalyse von Genen und Proteinen, Bioinformatik usw. im Mittelpunkt. Es werden angewandte Aspekte der Molekularbiologie, besonders für menschliche Krankheiten und Pflanzenzüchtung, diskutiert.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u></p> <p>Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Molekularbiologie mit Schwerpunkt auf genetischen Modellsystemen schaffen. Die Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Molekularbiologie vertraut gemacht. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der molekularbiologischen Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. • Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 			
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	
Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			

Prerequisite for taking the module:	-
Teaching unit:	Biology / Biochemistry

BIO-B-WM12: Cellular and Developmental Biology B		Anzahl der Leistungspunkte (LP): 6		
Module type (mandatory or elective module):	Depends on course of study			
Content and objective of module:	<p><u>Content:</u> Bei dieser Vorlesung stehen aktuelle Forschungsfragen und experimentelle Ansätze in der genetischen und molekularen Analyse der Zellbiologie und Entwicklung, wie beispielsweise die Zelldifferenzierung, Stammzellenbiologie, Musterbildung, Zellzykluskontrolle, Zellbeweglichkeit, die Regulierung des Organ- und Gewebewachstums, Morphogenese, Zelldifferenzierung etc. im Mittelpunkt. Es werden übergreifende Aspekte der Zell- und Entwicklungsbiologie, insbesondere hinsichtlich menschlicher Krankheiten und Pflanzenzüchtung diskutiert.</p> <p>Im Seminar werden detailliert wissenschaftliche Originalartikel über aktuelle Themen in der Biochemie diskutiert.</p> <p><u>Objectives:</u> Das Modul wird den Studierenden ein grundlegendes Verständnis von aktuellen Forschungsfragen und Methoden der Zell- und Entwicklungsbiologie mit Schwerpunkt auf genetischen Modellsystemen schaffen. Den Studierenden werden die theoretischen Grundlagen, wissenschaftlichen Ansätze und experimentelle Methoden in der Zell- und Entwicklungsbiologie vertraut gemacht. Das Modul wird Studenten spezielle Kenntnisse und Fähigkeiten in der molekularbiologischen Analyse von biologischen Prozessen lehren; diese bilden einen zentralen Teil des Masterstudiengangs, falls beabsichtigt wird, sich auf Genetik und Genomik, Molekulare, Zelluläre und Systembiologie zu spezialisieren.</p> <p>Insbesondere bedeutet das:</p> <ul style="list-style-type: none"> - Studenten lernen, wie man wissenschaftliche Originalliteratur in englischer Sprache liest und kritisch bewertet. - Studenten lernen, die wesentlichen Punkte aus der wissenschaftlichen Originalliteratur zu extrahieren. - Studenten können wissenschaftliche Fragen schriftlich in knapper Form diskutieren. - Studenten können ihre Arbeit einem wissenschaftlichen Publikum mit geeigneten Medien präsentieren und sich mit Fragen und/oder Kommentaren in einer wissenschaftlichen Diskussion über ihr Thema austauschen. • Studenten können prägnante Fragen über mögliche zukünftige Forschungsrichtungen stellen, um ein bestimmtes Problem weiterverfolgen zu können. 			
Module (partial) exam(s) (number, form, scope):	An examination in one of the following forms: Written exam, (90 min) Oral exam, (30 min)			
Independent study time (in hours):	120			
Courses (type of teaching)	Contact time (in semester hours)	Supplementary exam work (Number, form, scope)		Module (partial) exam(s) (Number, form, scope)
		For completing the module	For admission to the module exam	

Vorlesung oder Seminar (Vorlesung oder Seminar)	4	-	Presentation (15 min)	-
Offered:	each semester			
Prerequisite for taking the module:	-			
Teaching unit:	Biology / Biochemistry			