

Study Schedule Master

Molecular Cell Biology

		Compulsory modules				Elective modules			Internship; Study Abroad	Σ credits per semester
1. Sem.	Oct	Biochemistry 4 ECTS	Molecular Genetics 4 ECTS							30
	Nov			Developmental Biology and Physiology 4 ECTS	Molecular Cell Biology 4 ECTS					
	Dec					Biophysics and Statistics 4 ECTS				
	Jan	Mandatory Basic Course 8 ECTS								
	Feb		Examination Module 2 ECTS							
	March									
2. Sem.	Apr	Teacher Seminar Series 2 ECTS				Elective period 1	Elective period 2 5 ECTS	Elective period 3 5 ECTS		30
	May		Soft Skills Course / Bioethics 5 ECTS	Seminars / Journal Club 3 ECTS				Elective period 6 5 ECTS		
	June					Elective period 4 5 ECTS	Elective period 5 5 ECTS			
	July					Elective period 7 5 ECTS				
	Aug					Four electives to be taken in 4 out of 7 periods				
	Sep									
3. Sem.	Oct	Student Presentation 2 ECTS				Rotation 1 8 ECTS				30
	Nov						Rotation 2 8 ECTS			
	Dec							Project/Exchange 12 ECTS		
	Jan					Elective, Rotation, and Project/Exchange periods may be switched, if electives take place in Winter term and according to the needs of the students, Project/Exchange offering groups, etc.				
	Feb									
4. Sem.	March									30
	Apr									
	May									
	June				Master thesis 30 ECTS					
	July									
	Aug									
	Sep									
										120

Compulsory modules

Biochemistry lecture & tutorial 30 hours weekly contact time (4 SWS)	4 credits
Molecular Genetics lecture & tutorial 30 hours weekly contact time	4 credits
Developmental Biology and Physiology lecture & tutorial 30 h wklly contact time	4 credits
Molecular Cell Biology lecture & tutorial 30 h weekly contact time	4 credits
Biophysics and Statistics lecture & tutorial 30 hours weekly contact time	4 credits
Mandatory Basic Course practical exercise 40 hours weekly contact time	8 credits
Examination Module examination 1 hour contact time	2 credits

Teacher Seminar Series seminar 2 hours weekly contact time	2 credits
Soft Skills / Bioethics lecture / seminar 3 + 2 hours weekly contact time	5 credits
Seminars / Journal Club seminar 3 hours weekly contact time	3 credits

Student Presentation seminar 2 hours weekly contact time	2 credits
--	--------------


Master thesis	30 credits
----------------------	---------------


Elective modules


4 from 25 modules							
Analysis of snRNP assembly Practical exercise, 40 hours weekly contact time	5 credits	Optogenetics Practical exercise, 40 hours weekly contact time	5 credits	Molecular Biology of the Cell Practical exercise, 40 hours weekly contact time	5 credits	Mechanical Stress Protection Practical exercise, 40 hours weekly contact time	5 credits
Neuronal Cell Biology Practical exercise, 40 hours weekly contact time	5 credits	Transportphysiology Practical exercise, 40 hours weekly contact time	5 credits	Pharmacology & Metabolism Practical exercise, 40 hours weekly contact time	5 credits	Plant Transformation Practical exercise, 40 hours weekly contact time	5 credits
Quantitative Fluorescence Microscopy Practical exercise, 40 hours weekly contact time	5 credits	Biochemistry and Bioanalytics Practical exercise, 40 hours weekly contact time	5 credits	Molecular Membrane Biology Practical exercise, 40 hours weekly contact time	5 credits	Bioinformatics Lab Course Practical exercise, 40 hours weekly contact time	5 credits
Embryo Biotechnology Practical exercise, 40 hours weekly contact time	5 credits	Drugs from Plants and Microorganisms Practical exercise, 40 hours weekly contact time	5 credits	Biosyntheses of Natural Products Practical exercise, 40 hours weekly contact time	5 credits	Proteomics Practical exercise, 40 hours weekly contact time	5 credits
Preventive, Predictive and Personalised Medicine Practical exercise, 40 hours weekly contact time	5 credits	Cell Mechanics Practical exercise, 40 hours weekly contact time	5 credits	Biochemical Engineering Practical exercise, 40 hours weekly contact time	5 credits	Fluorescent Protein- based Biosensors Practical exercise, 40 hours weekly contact time	5 credits
Genome Stability Practical exercise, 40 hours weekly contact time	5 credits	Reconstructive Neurobiology Practical exercise, 40 hours weekly contact time	5 credits	Applications of Crispr/Cas to study neuronal function Practical exercise, 40 hours weekly contact time	5 credits	Methods in Developmental- and Tumorpathology Practical exercise, 40 hours weekly contact time	5 credits
Molecular Haematology Practical exercise, 40 hours weekly contact time	5 credits						


2 modules	
Rotation 1 Individual laboratory practical, 40 hours weekly contact time	8 credits
Rotation 2 Individual laboratory practical, 40 hours weekly contact time	8 credits


Internship	
Project/Exchange Individual laboratory practical, 40 hours weekly contact time	12 credits


Module Title: Biochemistry Module ID/Code: MCB-P1				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Energy metabolism pathways, enzymes, enzyme reactions and coenzymes. Posttranslational modifications as regulatory principle, analytical techniques				
Learning outcomes		Deeper understanding of biochemical foundations of the cell, properties and biosyntheses of proteins, nucleic acids and lipids.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	lecture	Biochemistry	English	25	10 h	80
	seminar	Tutorials in Biochemistry	English	25	20 h	40
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			compulsory		1
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						4 ECTS
Assessment (incl. weighting) and examination language		written examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	120 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Peter Dörmann, Prof. Dr. Andreas Meyer				
Module coordinator		Prof. Dr. Peter Dörmann				
Institute/Department		IMBIO (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Molecular Genetics Module ID/Code: MCB-P2				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Translation of the genetic information, regulation of the gene expression, translatory movement control, Posttranskriptionale mechanisms, Epigenetik. Methods of the molecular biology, manipulation of nucleid acids, genome Editing. Recombinant proteins, techniques and principles. Work with genome data and databases. Bases of the immune system into regard on antibody production. Antibody production and applications.				
Learning outcomes		Understanding of the principles of the gene regulation and the methods of molecular genetics.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	lecture	Molecular Genetics	English	25	10 h	80
	seminar	Tutorials in Molecular Genetics	English	25	20 h	40
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	1	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						4 ECTS
Assessment (incl. weighting) and examination language		Written examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	120 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Walter Witke				
Module coordinator		Prof. Dr. Walter Witke				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Developmental Biology and Physiology Module ID/Code: MCB-P3				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Knowledge of the methodology for the analysis of multicellularity and development. General principles of development; Signalling pathways and decision mechanisms of the cell differentiation, cell division: mitosis, meiosis, nuclei; understanding of the principles of development in animals and plants; pattern formation, tissue differentiation, organ development; tissue homeostasis and stem cells; cell ageing; reproductive medicine.				
Learning outcomes		Understanding of the cellular and molecular biological prerequisites of multicellularity and for the organismic events during the development.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	lecture	Developmental Biology and Physiology	English	25	10 h	80
	seminar	Tutorials in Developmental Biology and Physiology	English	25	20 h	40
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	1	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						4 ECTS
Assessment (incl. weighting) and examination language		written examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	120 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Oliver Gruß, Prof. Dr. Bernd Fleischmann (Physiology / Life & Brain, Medicine)				
Module coordinator		Prof. Dr. Oliver Gruß				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Molecular Cell Biology Module ID/Code: MCB-P4				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Organelles and compartments and their function. Cytoskeleton and cellular motors as an organizing element, membrane transport and general transport processes, ion canals. Protein sorting and proteostasis, apoptosis.				
Learning outcomes		Deeper understanding of cell organisation and cellular processes.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	lecture	Molecular Cell Biology	English	25	10 h	80
	seminar	Tutorials in Molecular Cell Biology	English	25	20 h	40
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	1	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						4 ECTS
Assessment (incl. weighting) and examination language		written examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	120 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Dieter Fürst, Prof. Dr. Albert Haas, Prof. Dr. Jörg Höfeld				
Module coordinator		Prof. Dr. Dieter Fürst				
Institute/Department		Cell Biology (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Biophysics and Statistics Module ID/Code: MCB-P5				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Introduction to biophysical and chemical calculations, biophysical bases of optics and microscopy, enzyme kinetics, spectroscopic methods in molecular biology, theory and methods of molecule interactions, methods for separation of macromolecules, application of statistical methods on experimental data sets.				
Learning outcomes		Insight into biophysical methods and introduction to the statistical evaluation of experiments.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	lecture	Biophysics and Statistics	English	25	10 h	80
	seminar	Tutorials in Biophysics and Statistics	English	25	20 h	40
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	1	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						4 ECTS
Assessment (incl. weighting) and examination language		written examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	120 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Dr. Pietro Pilo Boyl				
Module coordinator		Dr. Pietro Pilo Boyl				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Mandatory Basic Course Module ID/Code: MCB-MBC				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Cell culture techniques, methods of cell fractionation, isolation of nucleic acids and cloning, buffer calculations, techniques of protein biochemistry, application of antibodies, histology and microscopic methods. Proof and quantification of gene expression.				
Learning outcomes		Basic methods of molecular biology shall be learned and carried out independently in the practice. The course shall put the bases for subsequent 'Elective modules'. Contents are:				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Mandatory Basic Laboratory Skills	English	25	40 h	240 h
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			compulsory		
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements		Regular participation in the practical exercise				8 ECTS
Assessment (incl. weighting) and examination language		Practical report in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	240 h		8 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Hubert Schorle, Prof. Dr. Jörg Höhfeld, Prof. Dr. Dieter Fürst, Prof. Dr. Oliver Gruß, Prof. Dr. Walter Witke, Prof. Dr. Diana Imhof				
Module coordinator		Prof. Dr. Walter Witke				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Examination Module Module ID/Code: MCB-XM				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Proof of meeting qualification aims of the compulsory modules MCB-P1 to MCB-P5				
Learning outcomes						
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	self study	getting prepared for the examination	English	25		59 h
		examination	English	25		1 h
3. Prerequisites for the module						
compulsory		MCB-P1, MCB-P2, MCB-P3, MCB-P4, MCB-P5				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	1	
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						2 ECTS
Assessment (incl. weighting) and examination language		oral examination in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	60 h		
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher (examiners)		Coordinators of Modules MCB-P1, -P2, -P3, -P4, -P5				
Module coordinator		Prof. Dr. Walter Witke				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Teacher Seminar Series Module ID/Code: MCB-TSS				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		In this series, special topics in molecular biology and current research results are presented by the teachers				
Learning outcomes		Students learn about most recent topics and research in molecular cell biology				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Seminar	Current topics in molecular cell biology	English	25	2	60
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			compulsory		1	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements		Participation			2 ECTS	
Assessment (incl. weighting) and examination language		Proof of participation				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	60 hours	1 credit hour per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Docents of the Master's Program [P and EM modules]				
Module coordinator		Prof. Dr. Oliver Größ				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Soft Skills / Bioethics Module ID/Code: MCB-SSC				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	Current Topics: The course consists of <ul style="list-style-type: none">a lecture about text processing, formatting and layout, writing style in the life sciences, method of scientific citation, literature research and management, spreadsheet processing and diagrams, image processing and analysis, scientific posters and presentation. overview of free and open source software,a seminar presentation by each student about a selected current topic in molecular biotechnology, andwriting a scientific paper about the topic. Bioethics: Bioethical problems of biotechnological processes in food production, agriculture, animal breeding, medicine					
Learning outcomes	Soft Skills: current methods of data processing and visualization, literature research and management, scientific writing and presentation. Bioethics: selected literature on bio- and research ethics is used to make the students familiar with principles of ethical judgements with regard to bioscientific research and applications. The participants will be motivated to reflect on and analyze the ethical dimension of their own biotechnological fields of work and activities. The aim of the course is for the students to percieve ethical reflection as an integral element of their education and future work.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Lecture	Soft Skills	English	25	3 h	90
	Seminar	Bioethics	English	25	Block	60
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			compulsory		
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements		Participation				5 ECTS
Assessment (incl. weighting) and examination language		Proof of participation				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		5 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Dr. Karl Peter Linscheid, Priv.-Doz. Dr. Sebastian Knell (IWE, Philosophy)				
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Institute of Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Seminars / Journal Club Module ID/Code: MCB-SJC				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Attendance of seminars and journal clubs				
Learning outcomes		Awareness towards current research in molecular cell biology				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	seminar	Molecular Cell Biology	English	25	3 h	90 h
3. Prerequisites for the module						
compulsory						
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements		Participation			3 ECTS	
Assessment (incl. weighting) and examination language		Proof of participation				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	90 h	1 credit hour per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher						
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Student Presentation Module ID/Code: MCB-SP				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Students present their own work in rotations and Project/Exchange				
Learning outcomes		Awareness towards current research in molecular cell biology for students attending, development of presentation skills of students presenting				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	seminar	Molecular Cell Biology	English	25	2 h	90
3. Prerequisites for the module						
compulsory		Participation in rotations and Project/Exchange				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			compulsory	3	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements		Participation				2 ECTS
Assessment (incl. weighting) and examination language		Proof of participation				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	90 h	1 credit hour per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher						
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Analysis of snRNP assembly Module ID/Code: MCB-EM1				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the practical: <ul style="list-style-type: none">• Cell culture techniques for different cell lines• Live imaging of cells• Interfering with protein function inside cells: RNAi, Gene ko, small molecule inhibitors• Protein detection after knock-down or knock-out, quantification• Indirect immunofluorescence and light microscopy• Image quantification					
Learning outcomes	The practical course will provide insights into advanced techniques used in molecular biology. The students should learn methods and gain experience in planning and performing experiments independently.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Analysis of snRNP assembly	English	6	40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2 (1 st time frame)	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	Regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	Graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Oliver Gruß					
Module coordinator	Prof. Dr. Oliver Gruß					
Institute/Department	Genetics (Biology)					
Further information						
(Reading lists, information links etc.)						


Module Title: Optogenetics Module ID/Code: MCB-EM2				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The following contents will be covered by the practical: <ul style="list-style-type: none"> • Nucleic Acid Purification • Cell Culture Techniques • Cell Transfection • Gene Expression Studies • Microscopic Imaging Techniques • Fluorescence-based imaging • Optogenetics 				
Learning outcomes		The practical course will provide insights into how to apply optogenetics in tissue culture. The students should learn methods and gain experience in planning and performing experiments independently.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Optogenetics	English		40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective		2 (1 st time frame)	
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements		Regular participation in the practical exercise				5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report in English				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Dagmar Wachten				
Module coordinator		Prof. Dr. Dagmar Wachten				
Institute/Department		Innate Immunity (Medicine)				
Further information						
(Reading lists, information links etc.)						


Module Title: Molecular Biology of the Cell Module ID/Code: MCB-EM3				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the practical: <ul style="list-style-type: none">• Cell culture techniques• Differentiation and manipulation of cultured cells• Cell transfection and transduction• Knockdown of gene expression• High-resolution microscopic imaging of fluorescent proteins in cells• Analysis of protein localization, interactions and dynamics in living cells					
Learning outcomes	The practical course will provide insights into advanced techniques used in molecular cell biology. The students should learn methods and gain experience in planning and performing experiments independently.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Molecular Biology of the Cell	English	6	40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2 (3 rd time frame)	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	Regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	Graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Dieter O. Fürst					
Module coordinator	Prof. Dr. Dieter O. Fürst					
Institute/Department	Cell Biology (Biology)					
Further information						
(Reading lists, information links etc.)						


Module Title: Mechanical Stress Protection Module ID/Code: MCB-EM4				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the practical: <ul style="list-style-type: none">• Cell Culture Techniques• Expression of Recombinant Proteins• Protein Purification• Differentiation of Muscle Cells• Electrical Pulse Stimulation as an Exercise Model• Immunoprecipitation and Yeast-2-Hybrid System• Microscopic Imaging Techniques• Analysis of Protein Degradation Pathways					
Learning outcomes	Cells in multicellular organisms are constantly subjected to stress resulting from mechanical forces. The course will teach advanced biochemical and cell biological approaches to study molecular mechanisms that provide protection against mechanical stress. These mechanisms are fundamental for cell adhesion and migration and for the maintenance of tissues such as skeletal muscle and heart.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Methods in Mechanical Stress Protection	English	20	35 h	90 h
	Seminar	Mechanical Stress Protection	English	20	10 h	60 h
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2 (3 rd time frame)	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	Regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	Graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Jörg Höfeld					
Module coordinator	Prof. Dr. Jörg Höfeld					
Institute/Department	Cell Biology (Biology)					


Module Title: Mechanical Stress Protection Module ID/Code: MCB-EM4		 UNIVERSITÄT BONN
Further information		
(Reading lists, information links etc.)		


Module Title: Neuronal Cell Biology Module ID/Code: MCB-EM5				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The following contents will be covered by the practical: <ul style="list-style-type: none"> • Neuronal cell culture • Transfection of neurons • Immunocytochemistry • Fluorescent Microscopy • Live Cell Microscopy • Whole Tissue Imaging techniques 				
Learning outcomes		The practical course will provide insights into advanced techniques used in neuronal cell biology. The students should learn methods and gain experience in planning and performing experiments independently.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Neuronal Cell Biology	English	6	40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective		2	
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements		Regular participation in the practical exercise				5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report (50 %) and oral examination (50 %) in English				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Walter Witke, Prof. Dr. Frank Bradke (DZNE)				
Module coordinator		Prof. Dr. Walter Witke				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Transportphysiology Module ID/Code: MCB-EM6				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	In the lab course relevant examples of plant environment interactions from the molecular to the organismic level will be studied. Experiments will deal with water and salt stress, effects of xenobiotics on plants, plant microorganism interaction and secondary plant metabolites. Experimental approaches include measurement of chlorophyll fluorescence, porometry, measurement of cuticular transpiration and uptake of xenobiotics in leaves and analysis of gene expression in response to environmental stimuli. Experiments will be conducted with model and crop species.					
Learning outcomes	The practical course will provide insights into modern techniques used in molecular plant physiology and ecology. The students should learn different methods in transport physiology and gain experience in planning and performing experiments independently.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Transportphysiology	English	2	40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2 (3 rd time frame)	
	Plant Sciences (M.Sc.)					
	OEP Biology (M.Sc.)					
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	Regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	Graded written examination in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Lukas Schreiber				
Module coordinator		Prof. Dr. Lukas Schreiber				
Institute/Department		Cellular and Molecular Botany (Biology)				
Further information						
(Reading lists, information links etc.)		1. Taiz L, Zeiger E (2006) Plant Physiology. Sinauer Associates Inc., Sunderland, MA, 2. Schulze ED, Beck E, and Müller-Hohenstein K. Plant Ecology, Heidelberg: Springer, 2005				


Module Title: Pharmacology & Metabolism Module ID/Code: MCB-EM7				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The following contents will be covered by the practical: <ul style="list-style-type: none"> • Murine primary adipocyte isolation and culture • Human adipocyte cell culture • Pharmacological intervention of experimental model system • Ex vivo and in vitro metabolic measurements (including oxygen consumption, energy expenditure, lipolysis, mitochondrial function, etc.) • Data collection, analysis and interpretation 				
Learning outcomes		This module is dedicated to understanding and investigating how small molecular modulators can be used to specifically target prominent metabolic pathways using the mouse as an experimental animal model. Attendees will be introduced to murine animal handling, murine primary adipocyte isolation and <i>in vivo</i> , <i>ex vivo</i> and <i>in vitro</i> pharmacological experimentation with the model system. The practical work will be supported by seminars covering, among other, signal transduction, metabolism and pharmacology.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Molecular Biology	English	6	40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective		2	
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements		Regular participation in the practical exercise				5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report in English				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Alexander Pfeifer				
Module coordinator		Prof. Dr. Alexander Pfeifer				
Institute/Department		Pharmacology and Toxicology (Medicine)				
Further information						
(Reading lists, information links etc.)						


Module Title: Plant Transformation Module ID/Code: MCB-EM8				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The practical lab exercise on plant expression systems will focus on techniques of generating transgenic plant lines employing different plant species including tobacco and Arabidopsis. Modern plant sciences involve different culture systems and transformation protocols. The most relevant techniques will be presented during this lab course. Laboratory techniques in modern cell biology, microscopy and visualization. Skills for documentation and presentation of scientific experiments and data.					
Learning outcomes	Biolistic transformation of plants (leaf discs) with reporter constructs, <i>Agrobacterium</i> -mediated transformation, cloning in <i>Escherichia coli</i> and <i>Agrobacterium tumefaciens</i> , screening of transgenic lines, detection of transgenes by PCR, histochemical and biochemical methods.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Plant transformation	English		40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language	Graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Peter Dörmann					
Module coordinator	Prof. Dr. Peter Dörmann					
Institute/Department	Molecular Physiology and Biotechnology of Plants (Biology)					
Further information						
(Reading lists, information links etc.)						


Module Title: Quantitative Fluorescence Microscopy Module ID/Code: MCB-EM9				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The following contents will be covered by the practical: <ul style="list-style-type: none">• Transient and stable expression of fluorescent proteins• SNAP-, Halo, Clip-tag labelling• Super resolution confocal laser scanning microscopy• Fluorescence recovery after photobleaching (FRAP)• Analysis of intracellular protein mobility• Förster resonance energy transfer (FRET) measurements• Quantitative image analysis• 3D image reconstruction				
Learning outcomes		The practical course will provide insights into advanced light microscopy techniques used in molecular cell biology. The students should learn methods and gain experience in planning and performing experiments independently.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Lecture	Microscopy and Image Processing	English	6	6 h	30
	Practical exercise	Quantitative Fluorescence Microscopy	English	3x2	34 h	120
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			elective		
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language						
Graded practical report in English						
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Ulrich Kubitscheck				
Module coordinator		Prof. Dr. Ulrich Kubitscheck				
Institute/Department		Physical and Theoretical Chemistry (Chemistry)				
Further information						
(Reading lists, information links etc.)		Fluorescence Microscopy: From Principles to Application, 2 nd edition, Wiley-VCH, ed. U. Kubitscheck				


Module Title: Biochemistry and Bioanalytics Module ID/Code: MCB-EM10				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Strategies and methods of analytical biochemistry with focus on protein biochemistry, qualitative and quantitative analysis of protein-protein/ligand-interactions and bioactivity assays: <ul style="list-style-type: none"> • Expression of recombinant proteins in <i>E. coli</i> • Protein purification and analysis (MALDI-TOF, SDS-PAGE) • Binding studies (e.g. UV/Vis, MST, ITC, BLITZ) • Activity studies (chromogenic/fluorogenic assays) • Enzyme kinetics and enzyme/protein regulation 				
Learning outcomes		The students will develop in-depth knowledge and practical exercise regarding modern techniques and methods in biochemistry and bioanalytics, gain experience in planning and performing experiments, and evaluate original literature independently.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Biochemistry and Bioanalytics	English		36 h	130
	Seminar				4 h	20
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective			
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					5 ECTS	
Assessment (incl. weighting) and examination language						
Graded practical report (70 %) and seminar presentation (30 %) in English						
7. Frequency				8. Workload		9. Duration
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Diana Imhof, Dr. Toni Kühl				
Module coordinator		Prof. Dr. Diana Imhof				
Institute/Department		Pharmacy				
Further information						
(Reading lists, information links etc.)						


Module Title: Molecular Membrane Biology Module ID/Code: MCB-EM11				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents are typically covered by the practical: <ul style="list-style-type: none">• Cell culture with macrophages and epithelial cells• Subcellular fractionation and biochemical analysis of fractions• Membrane purification• Membrane fusion with purified components• Gene expression knock-down with siRNA• Fluorescence microscopy• Computer-assisted image analysis					
Learning outcomes	The practical course will provide insights into advanced techniques used in molecular cell biology. The students should learn current methods and gain experience in planning and performing experiments.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Molecular Membrane Biology	English	6	60 h	100
	Seminar and lectures				20 h	50
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			elective		2
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report (70 % of final grade) and graded seminar presentation (30% of final grade) in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Albert Haas				
Module coordinator		Prof. Dr. Albert Haas				
Institute/Department		Cell Biology Institute (Biology)				
Further information						
(Reading lists, information links etc.)						


Module Title: Bioinformatics Lab Course Module ID/Code: MCB-EM12				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Practical introduction to algorithmics, bio-databases, modelling, programming				
Learning outcomes		Application oriented basic knowledge of bioinformatic methods				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Bioinformatics	English		40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective		2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					5 ECTS	
Assessment (incl. weighting) and examination language					Graded practical report in English	
7. Frequency				8. Workload		9. Duration
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Martin Hofmann-Apitius				
Module coordinator		Prof. Dr. Martin Hofmann-Apitius				
Institute/Department		B-IT-Center (Informatics)				
Further information						
(Reading lists, information links etc.)						


Module Title: Embryo Biotechnology Module ID/Code: MCB-EM13				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	<ul style="list-style-type: none">gene transfer techniques - mammalian and bird embryos, fish, invertebrates, ES cell system, somatic gene transfer;embryo technology - handling and culture of embryos, micromanipulation, freezing technique, transfer of nuclei, microinjection;DNA integration - vector integration, expression and function;use of transgenic animals - gene function, animal models, recombinant proteins, new genetic properties					
Learning outcomes	Overview of production of transgenic animals; insight into use of transgenic animals in biological research and biotechnological application.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Embryo Biotechnology	English		40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Priv.-Doz. Dr. Michael Hölker				
Module coordinator		Priv.-Doz. Dr. Michael Hölker				
Institute/Department		Animal Science (Agriculture)				
Further information						
(Reading lists, information links etc.)						


Module Title: Drugs from Plants and Microorganisms Module ID/Code: MCB-EM14				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	Biosynthesis and analysis of physiologically active natural products: isolation and chemical analysis of natural products (HPLC, TLC, GC, NMR); biosynthesis of antibiotics, detection of genes for biosynthetic pathways, recombinant drugs, production and mode of action of chemotherapeutics.					
Learning outcomes	The students get an overview of structures and biosynthesis of natural products, the course provides knowledge of molecular biological analysis and identification of biosynthesis genes, enzymes and proteins.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Drugs from Plants and Microorganisms	English		36 h	120
	Seminar				4 h	30
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	3	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language	Graded practical report (34 %), written examination (33 %), seminar presentation (33 %) in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher	Dr. Stefan Kehraus					
Module coordinator	Dr. Stefan Kehraus					
Institute/Department	Pharmaceutical Biology (Pharmacy)					
Further information						
(Reading lists, information links etc.)						


Module Title: Biosyntheses of Natural Products Module ID/Code: MCB-EM15				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Overview of the structure and biosynthesis of natural products, analysis and identification of genes for biosynthetic pathways, enzymes and proteins using molecular methods (PCR, electrophoresis, blotting techniques).				
Learning outcomes		The students get an overview of structures and biosynthesis of natural products, the course provides knowledge of molecular biological analysis and identification of biosynthesis genes, enzymes and proteins.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Biosyntheses of Natural Products	English		36 h	120
	Seminar				4 h	30
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			elective		3
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language		Graded practical report (34 %), written examination (33 %), seminar presentation (33 %) in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Dr. Stefan Kehraus				
Module coordinator		Dr. Stefan Kehraus				
Institute/Department		Pharmaceutical Biology (Pharmacy)				
Further information						
(Reading lists, information links etc.)						


Module Title: Proteomics Module ID/Code: MCB-EM16				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		Protein isolation and characterisation using mass spectrometry. Analysis of post-translational protein modifications.				
Learning outcomes		Students learn to identify, isolate and characterise proteins from tissues of moleculogenetically well defined model organisms.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise		English		40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	3	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					5 ECTS	
Assessment (incl. weighting) and examination language		Graded practical report in English				
7. Frequency				8. Workload	9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)	
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Priv.-Doz. Dr. Simone Diestel, Dr. Marc Sylvester (Molecular Biology, Medicine)				
Module coordinator		Priv.-Doz. Dr. Simone Diestel				
Institute/Department		Human Nutrition and Food Science (Agriculture)				
Further information						
(Reading lists, information links etc.)						


Module Title: Preventive, Predictive and Personalised Medicine Module ID/Code: MCB-EM17				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	<ul style="list-style-type: none">Significance of early or preventative diagnostics in cardiovascular and tumor diseases,application of modern biotechnologies in medical diagnostics,introduction into molecular and minimally invasive diagnostic technologies,development of pathology-specific biomarkers.					
Learning outcomes	<ul style="list-style-type: none">Metabolic pathways affected in pathomechanisms of cardiovascular complications secondary to Diabetes mellitus type II,metabolic pathways affected in pathomechanisms of neurodegenerative diseases,metabolic pathways affected in pathomechanisms of selected tumors, using the examples of glioblastoma and breast cancer,stress and repair mechanisms (comet assay technology),role and evaluation of tissue remodelling-protein complexes (technology of zymography),pathology specific expression patterns (technologies of clinical proteomics and real-time PCR),analysis of disease-specific expression arrays,written summary of the experimental design and results, presentation of a research hypothesis.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Preventive, Predictive and Personalised Medicine	English	8	36 h	120
	Seminar				4 h	30
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						5 ECTS
Assessment (incl. weighting) and examination language		Written practical report (60 %), written examination (20 %), seminar presentation (20 %) in English				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Olga Golubnitschaja				
Module coordinator		Prof. Dr. Olga Golubnitschaja				
Institute/Department		Radiology (Medicine)				


Module Title: Preventive, Predictive and Personalised Medicine Module ID/Code: MCB-EM17		 UNIVERSITÄT BONN
Further information		
(Reading lists, information links etc.)		


Module Title: Cell Mechanics Module ID/Code: MCB-EM18				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	<ul style="list-style-type: none">▪ Mechanical functions of the cell: live cell imaging and immunocytochemistry, substrate deformation and cellular force analysis of animal cells under various conditions and at different stages of cellular differentiation;▪ Mechanical properties of the cell: atomic force microscopy (AFM) to measure the elasticity of cells under various conditions and at different stages of differentiation, high-resolution visualization of cytoskeletal structures, analysis of the influence of selective mechanical stimuli on the induction of cellular reactions, analysis of cellular viscoelasticity in the context of molecular mobility;▪ Mechanical signals recognized by the cell: evaluation of parameters to control cellular behavior and differentiation – substrate stiffness, substrate stretch, topography – including morphological and functional tests.					
Learning outcomes	Animal cells are continuously in contact with their environment and able to send as well as receive signals. In addition to chemical signals, mechanical signals play a pivotal role by regulating a plethora of essential cellular functions like embryogenesis, cell migration, adhesion, formation of multicellular structures, morphology, and differentiation. The aim of this module is to exactly analyze the diverse mechanical signals within animal organisms in order to elucidate the functioning of widespread mechanosensitive processes. This concept will help to understand that in experimental setups, which are designed close to the in vivo situation, a combination of chemical and mechanical signals must be used. To characterize cellular mechanics, cellular forces required for the function of each individual cell in processes of adhesion and migration, are analyzed. In addition to the mechanical forces induced by the cell itself, animal cells also react to mechanical signals from the surrounding tissue. These signals may induce minor adaptations as well as major processes of cellular differentiation or vectored migration and are more closely investigated through the parameters substrate elasticity, topography, and environmental stretch. Since virtually every mechanical event has an impact on cell viscosity and elasticity, the evaluation of these parameters completes the analysis of cellular mechanics.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise		English		40 h	150
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	3	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements						5 ECTS
Assessment (incl.	Graded practical report in English					


Module Title: Cell Mechanics Module ID/Code: MCB-EM18				 UNIVERSITÄT BONN	
weighting) and examination language					
7. Frequency			8. Workload		9. Duration
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>				
Module coordination					
Teacher		Priv.-Doz. Dr. Bernd Hoffmann			
Module coordinator		Priv.-Doz. Dr. Bernd Hoffmann			
Institute/Department		Complex Systems (FZ Jülich)			
Further information					
(Reading lists, information links etc.)					


Module Title: Biochemical Engineering Module ID/Code: MCB-EM19				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The students work in a laboratory environment in the scientific groups of the departments involved in the study program.				
Learning outcomes		Guided experimental work in the laboratory				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise		English		40 h	150
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
Study program			compulsory/ elective		Semester	
Molecular Cell Biology (M.Sc.)			elective		2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					5 ECTS	
Assessment (incl. weighting) and examination language		Graded practical report in English				
7. Frequency				8. Workload		9. Duration
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher		Prof. Dr. Marco Oldiges				
Module coordinator		Prof. Dr. Marco Oldiges				
Institute/Department		Bio- and Geosciences (FZ Jülich)				
Further information						
(Reading lists, information links etc.)						


Module Title: Fluorescent Protein-based Biosensors				 UNIVERSITÄT BONN		
Module ID/Code: MCB-EM20						
1. Content and intended learning outcomes						
Content	Expression of recombinant proteins in <i>E. coli</i> ; spectral characterization of purified fluorescent proteins; selection of transgenic plants; ratiometric laser scanning microscopy; image analysis; Gateway cloning; transient expression of membrane proteins tagged with GFP-based biosensors in tobacco; membrane isolation and protein protection assays					
Learning outcomes	Generation and validation of genetically encoded biosensors; application of GFP-based probes for dynamic in vivo measurements of physiological parameters and for the analysis of membrane proteins					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Fluorescent Protein-based Biosensors	English	4	40 h	150 h
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			elective		3
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements	regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Andreas Meyer					
Module coordinator	Prof. Dr. Andreas Meyer					
Institute/Department	Crop Science and Resource Conservation (Agriculture)					
Further information						
(Reading lists, information links etc.)						


Module Title: Genome Stability Module ID/Code: MCB-EM21				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the practical: <ul style="list-style-type: none">▪ Nucleic Acid Purification▪ Protein Purification▪ Microscopic Imaging Techniques▪ Southern Blot analysis▪ Yeast genetics▪ Molecular cloning techniques					
Learning outcomes	The practical course will provide insights into advanced techniques used in molecular biology with the focus in telomere biology. The students should learn methods and gain experience in performing experiments independently and set them into context of the current literature					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Telomere Biology	English	4 - 6	40 h	
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements	regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Katrin Paeschke					
Module coordinator	Prof. Dr. Katrin Paeschke					
Institute/Department	Haematology/Oncology (Medicine)					
Further information						
(Reading lists, information links etc.)						


Module Title: Reconstructive Neurobiology (Molecular tools for stem and developmental biology) Module ID/Code: MCB-EM22				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the practical: <ul style="list-style-type: none">• Strategies to generate mouse models for the investigation of neurodevelopmental processes• Molecular mechanisms underlying neural fate determination• Extrinsic factor-driven differentiation and patterning• Forced expression of transcription factors and use of small molecules for forward programming approaches• Direct conversion of somatic cells into neural stem cells• Generation of 3D cortical organoids• Genetically engineered reporter gene systems for image-based phenotype analysis• Principles of primer design and construct engineering for setting up phenotype-specific reporter assays• Microscopy of 2D and 3D cultures (light sheet, bright field, high content and fluorescence)• Immunofluorescence imaging					
Learning outcomes	During this practical course students gain insight into the molecular mechanisms underlying the development of the central nervous system in mouse and human. They learn about tools used in mouse genetics and cell programming strategies applied in human stem cell biology. In particular, they acquire knowledge on the generation of iPS cells and their genetic modification via genome editing. After successful participation, attendees should be able to apply these tools for experimentally addressing questions relating to mouse developmental biology, human stem cell biology and genome editing. Attendees will design gRNAs for CRISPR/Cas9-based editing and use assays to evaluate genome editing efficiency. Furthermore, students prepare embryonic tissue for 3D imaging analysis, perform immunohistochemistry and RNA in situ hybridization on mouse brain sections and analyze the specimens using advanced microscopy techniques. In addition, students get insight into transcription factor based fate programming, learn to establish 3D cortical organoids and get to know the principles of image-based analyses of cellular (patho-) phenotypes using specific genetically engineered reporter assays. A particular focus is put on the discussion of the possibilities but also limitations of the presented techniques.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Experimental neurobiology and stem cell biology	English	10	40 h	150 h
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	


Module Title: Reconstructive Neurobiology (Molecular tools for stem and developmental biology) Module ID/Code: MCB-EM22				 UNIVERSITÄT BONN	
5. Requirements for the award of credits (ECTS)					6. Credits
Required achievements		regular participation in the practical exercise			5 ECTS
Assessment (incl. weighting) and examination language		Graded, oral presentation of a recent high-impact publication in English			
7. Frequency				8. Workload	9. Duration
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h	3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>				
Module coordination					
Teacher		Prof. Dr. Oliver Brüstle; Prof. Dr. Sandra Blaess			
Module coordinator		Prof. Dr. Oliver Brüstle			
Institute/Department		Reconstructive Neurobiology (Medicine)			
Further information					
(Reading lists, information links etc.)					


Module Title: Applications of Crispr/Cas to study neuronal function Module ID/Code: MCB-EM23				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The following contents will be covered by the course: <ul style="list-style-type: none">• Crispr/Cas background (lecture)• Crispr/Cas applications in neurobiological research (lecture)• Generation and application of viral vectors (lecture)• Design of Crispr/Cas vectors (practical)• Preparation of viral vectors (practical)• Cell culture (practical)• Analysis of cells edited with Crispr/Cas (fluorescence imaging, multi-electrode array recordings, time lapse imaging, luciferase) (practical)					
Learning outcomes	The course will provide an introduction into the usage of Crispr/Cas and the generation of viral vectors in neurobiological research on a theoretical level, on a practical level, and give an introduction into data analysis.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Crispr/Cas	English	4	36 h	120
	Lectures				3 h	15
	Seminars				1 h	15
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	2	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	regular participation in the practical exercise				5 ECTS	
Assessment (incl. weighting) and examination language	Graded written examination (50 %) and graded seminar presentation (50 %) in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Ina Vorberg (DZNE) Prof. Dr. Susanne Schoch McGovern (Neuropathology)					
Module coordinator	Prof. Dr. Ina Vorberg, Prof. Dr. Susanne Schoch McGovern					
Institute/Department	Neuropathology (Medicine)					
Further information						
(Reading lists, information links etc.)						


Module Title: Methods in Developmental- and Tumorpathology Module ID/Code: MCB-EM24				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content	The practical comprises: isolation of molecules (RNA) from animal cells or tissues, reverse transcription PCR, gene specific PCR reactions, quantitative real-time PCR, gel electrophoresis, quantitative real time PCR and end point PCR data analysis, candidate gene analysis with <i>in situ</i> hybridization (ISH), fragment sequencing, sequence data analysis, use of public data bases.					
Learning outcomes	The practical provides insights into basic and advanced techniques in molecular biology					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	Methods in Developmental- and Tumorpathology	English	8	38 h	90 h
	Seminar	Developmental- and Tumorpathology	English	8	4 h	60 h
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology (M.Sc.)			elective		2
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements	regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					
Module coordination						
Teacher	Prof. Dr. Hubert Schorle					
Module coordinator	Prof. Dr. Hubert Schorle					
Institute/Department	Pathology (Medicine)					
Further information						
(Reading lists, information links etc.)						


Module Title: Molecular Haematology				 UNIVERSITÄT BONN		
Module ID/Code: MCB-EM25						
1. Content and intended learning outcomes						
Content	<ul style="list-style-type: none">- Identification of patients coagulation disorders:<ul style="list-style-type: none">a. Coagulation assays (e.g. whole blood and plasma-based global coagulation assays, detection of coagulation factor inhibiting antibodies)b. DNA preparation from blood, PCR, Sanger sequencing and analysis- Investigation of the identified mutation by several strategies in order to characterize the phenotype:<ul style="list-style-type: none">a. Cloning of target cDNA into a vector by restriction-free cloning PCR, mutagenesis PCR, transfection and expression in mammalian cell line and genetically modified cell lines (CRISPR/Cas9), analysis of the mutant protein by coagulation based assays (e.g. ELISA)b. Reprogramming of patient and WT blood in induced pluripotent stem (IPS) cells, characterization of IPS cells (intracellular staining of pluripotency markers, embryoid body formation), cultivation of IPS cells (Clump splitting), differentiation into endothelial cellsc. Protein modelling of wild-type and mutated protein					
Learning outcomes	The aim of this module is to identify and further characterize patient's phenotype by different methods. The students will learn how to plan a project and develop several strategies to investigate specific mutations on DNA and protein level. The course provides knowledge about current techniques used in molecular biology including DNA analysis, cell culture, cell-based assays and in silico modelling.					
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	From patient to phenotype characterization	English	6	40 h	80 h
3. Prerequisites for the module						
compulsory	Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM					
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective		
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements	regular participation in the practical exercise					5 ECTS
Assessment (incl. weighting) and examination language	graded practical report in English					
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	150 h		3 credit hours per week (SWS)
Summer semester	<input checked="" type="checkbox"/>					

Module Title: Molecular Haematology Module ID/Code: MCB-EM25		 UNIVERSITÄT BONN
Module coordination		
Teacher	Dr. Katrin Czogalla-Nitsche	
Module coordinator	Prof. Dr. Johannes Oldenburg	
Institute/Department	Experimental Haematology and Transfusion Medicine (Medicine)	
Further information		
(Reading lists, information links etc.)		

Module Title: Rotation 1 Module ID/Code: MCB-EM91				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The students work in an laboratory environment in the scientific groups of the departments involved in the study program.				
Learning outcomes		Guided experimental work in the laboratory				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	individual	English	individual	40 h	240
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective		
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					8 ECTS	
Assessment (incl. weighting) and examination language						
7. Frequency				8. Workload	9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	240 h		
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Teachers of the program				
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						

Module Title: Rotation 2 Module ID/Code: MCB-EM92				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The students work in an laboratory environment in the scientific groups of the departments involved in the study program.				
Learning outcomes		Guided experimental work in the laboratory				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical exercise	individual	English	individual	40 h	240
3. Prerequisites for the module						
compulsory		Participation in basic modules MCB-P1 - MCB-P5 (min. 3 out of 5 successfully/pass), successful participation (pass) in MCB-MBC, and successful (pass) MCB-XM				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective		
5. Requirements for the award of credits (ECTS)						6. Credits
Required achievements						8 ECTS
Assessment (incl. weighting) and examination language						
7. Frequency			8. Workload		9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>			
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Teachers of the program as teachers and/or examiners				
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						

Module Title: Project/Exchange Module ID/Code: MCB-PE				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content						
Learning outcomes						
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Practical	Project/Exchange, individual	English	Individual	40	360
3. Prerequisites for the module						
compulsory		Successful participation in basic modules MCB-P1 - MCB-P5, MCB-MBC, and MCB-XM; min. 60 credit points accumulated from previous examinations				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective	Semester	
	Molecular Cell Biology (M.Sc.)			elective	3	
5. Requirements for the award of credits (ECTS)					6. Credits	
Required achievements					12 ECTS	
Assessment (incl. weighting) and examination language						
7. Frequency				8. Workload	9. Duration	
Winter semester	<input checked="" type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	360 h		
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Teachers of the program				
Module coordinator		Dr. Karl Peter Linscheid				
Institute/Department		Molecular Physiology and Biotechnology of Plants (Biology)				
Further information						
(Reading lists, information links etc.)						

Module Title: Master Thesis Module ID/Code: MCB-MT				 UNIVERSITÄT BONN		
1. Content and intended learning outcomes						
Content		The Master Thesis is the final part of the studies. The students work in a laboratory environment in the scientific groups of the departments involved in the study program. Their work usually contributes to a project leading to a scientific publication. Towards the end of the semester, the students present their results in a seminar.				
Learning outcomes		The previously acquired knowledge and skills are to be practically applied in the context of a well-defined scientific problem.				
2. Teaching and learning methods						
	Type of instruction	Topic	Language of instruction	Group size	Weekly contact time	Workload [h]
	Project	Master project	English	Individual project	40	720
	Thesis					150
	Seminar					30
3. Prerequisites for the module						
compulsory		Successful participation in basic modules MCB-P1 - MCB-P5, MCB-MBC, and MCB-XM; min. 78 credit points accumulated from previous examinations				
recommended						
4. Degree program allocation						
	Study program			compulsory/ elective		Semester
	Molecular Cell Biology			compulsory		4
5. Requirements for the award of credits (ECTS)						6. Credits 30 ECTS
Required achievements		having submitted the thesis in time and given the presentation				
Assessment (incl. weighting) and examination language		Graduation dissertation in English assessed by two referees				
7. Frequency			8. Workload		9. Duration	
Winter semester	<input type="checkbox"/>	Winter and summer semester	<input type="checkbox"/>	900 h		
Summer semester	<input type="checkbox"/>					
Module coordination						
Teacher		Postdoctoral (habilitated) teachers of the program				
Module coordinator		Prof. Dr. Walter Witke				
Institute/Department		Genetics (Biology)				
Further information						
(Reading lists, information links etc.)		Rogers (2007): Mastering Scientific and Medical Writing. Springer, Berlin, Heidelberg https://rd.springer.com/book/10.1007/978-3-540-34508-4				