

[E1.16]	Molecular Biosciences	Compulsory elective module	6 CP (total) = 180 h		4 SWS
			Contact hours 4 SWS / 60 h	Independent study 120 h	
Content					
<p>In this module, four lectures from the field of molecular biosciences must be taken. The lectures deal with different molecular aspects of biology.</p> <p>The following lectures can be attended:</p> <p>First semester half</p> <p>Plant Biochemistry: The lecture addresses the biochemistry of chloroplasts and regulation phenomena between nucleus and plastid. Plants as well as eukaryotic algae, specifically diatoms, are in focus. One topic is the regulation by photoreceptors. The different ways to gain genetically modified plants and algae are introduced and discussed.</p> <p>Bioinformatics - From Sequence to Function: The focus is on analyzing raw data from genome or transcriptome sequencing, assembling, and annotating genomes or transcriptomes, transferring functional annotations supported by homology, considering relevant sequence databases, reconstructing individual metabolic pathways, and comparing them across species.</p> <p>Plant Physiology: The lecture course "Plant Physiology" focuses on the developmental, metabolic, and sensory physiology and biotechnology of plants. It emphasizes the interactions of plants with the environment, signal transduction, and regulation.</p> <p>RNA – structure and function: The lecture covers the basics of the function and structure of ribonucleic acids, including the chemical structure and conformation of RNA building blocks, the secondary and tertiary structure of RNA, regulatory RNA elements in prokaryotes, structure, and function of enzymatically active RNAs (ribozymes), and RNA aptamers and their applications.</p> <p>Second semester half</p> <p>Molecular & Applied Microbiology: In the lecture, the principles of petrochemical-based technologies for the production of commodities will be discussed, followed by biotechnological alternatives that are already implemented in bacteria and yeast, leading to discuss a novel, sustainable and climate-friendly CO₂-based bioeconomy.</p> <p>Plant Developmental Genetics: This course covers the classical and modern plant developmental genetics, including the generation and characterization of genetically modified plants. Additionally, fundamental knowledge of state-of-the-art fluorescence-based imaging techniques used for cellular localization and protein-protein interactions is imparted, such as confocal laser scanning microscopy and Förster Resonance Energy Transfer (FRET).</p> <p>Biosynthesis of Natural Substances: The focus will be on the biosynthesis of polyketides, complex peptides, alkaloids, and terpenes. We will discuss typical reaction mechanisms and processes using selected biosynthetic pathways. Additionally, we will explore traditional and modern methods in natural product research, ranging from bioactivity-guided fractionation to computer-aided methods for identifying novel natural products (genome mining) and the latest techniques in synthetic biology.</p> <p>RNA Biology of Eukaryotes: The lecture teaches the versatile structures and functions of ribonucleic acids (RNAs) and RNA-protein complexes (RNPs), the mechanisms of regulation of gene expression in eukaryotes and various methods for their investigation. Contents of the lecture are "Pre-mRNA splicing and the regulation of alternative splicing", "Non-coding RNAs and nuclear architecture", "Post-transcriptional regulation of gene expression", "Translation and RNA degradation", as well as classical and new methods for the investigation of gene expression".</p> <p>Molecular Cell Biology and Biochemistry of Eukaryotic Systems: This lecture provides a combination of theoretical knowledge and hands-on experience. The courses cover important topics of Cell Biology of Higher Eukaryotes, with a focus on intracellular transport and membrane biology, as well as the cellular biochemistry of eukaryotes, using examples from mammalian cells, yeast, and plants. Special emphasis is placed on various aspects of protein homeostasis, the function and regulation of molecular chaperones, signal transduction and its specificities in different systems, protein transport in cells from synthesis to degradation, flow of proteins within the cell and across membranes, and organelle and protein complex dynamics.</p> <p><i>Four lectures must be chosen. Students are advised to chose 2 lectures per semester half.</i></p>					
Learning outcomes and skills					
Upon completion of this module, students will have an overview of a spectrum of specific aspects of biochemistry, genetics, structural and molecular biology in microbiology and plant biology. This special knowledge helps the students in the preparation of seminar papers and in the search for a research field.					
Admissions requirements/Conditions for participation in the module/courses					
None					
Recommended prior knowledge					
None					
Organizational details					
Partial import module of the master's degree in biosciences. The registration and cancellation deadlines of the regulations for the Bachelor's degree in Biochemistry apply.					
Module allocation (degree programme/faculty)			Master Molecular Biosciences / FB15		
Eligibility of the module for other courses			Master Biochemistry / FB14		
Module offered			summer semester		
Duration			1 semester		
Module coordinator			Prof. Büchel		
Course requirements for credits					

Participation record							
Coursework	Exam for each lecture (30 min. each)						
Forms of teaching / learning	lecture						
Language teaching and instruction	English						
Module assessment	Form / duration / content, if applicable						
Final module assessment	None						
Cumulative module assessment consisting of							
Composition of the module grade for cumulative module assessment							
		Mode of teaching / study	Semester hours per week	Semester CP			
				1	2	3	4
<i>First half of semester:</i>							
Plant Biochemistry		L	1		1.5		
Bioinformatics - From Sequence to Function		L	1		1.5		
Plant Physiology		L	1		1.5		
RNA – Structure and Function		L	1		1.5		
<i>Second half of semester:</i>							
Molecular and Applied Microbiology		L	1		1.5		
Plant Developmental Genetics		L	1		1.5		
Biosynthesis of Natural Products		L	1		1.5		
RNA Biology of Eukaryotes		L	1		1.5		
Molecular Cell Biology and Biochemistry of Eukaryotic Systems		L	1		1.5		
TOTAL			4		6		