This is a translation of the original
" Modulkatalog
Bachelor of Science Biologie
gültig für Studienanfänger und Studienanfängerinnen
ab dem Wintersemester 2026/27".
Only that original is legally binding.
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Module catalogue
Bachelor of Science in Biology
Valid for first-year students
from the 2026/27 winter semester

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Key:
P = Compulsory, WP = Compulsory elective, SWS = Semester weekly hours (1 SWS = 60 mins per semester week),
CP = credit points (1 CP = 30 hours' workload), V = lecture, Ü = tutorial

Module BIO-BSc-01

1. Name of the module	**Allgemeine Biologie – Zellbiologie und Botanik** **General Biology – Cell Biology and Botany**
2. Department / Person responsible	Cell Biology and Botany / Prof. Dr Thomas Dresselhaus
3. Module content	Basic knowledge of general and molecular cell biology and an overview of the fundamental aspects of botany. **Lecture on Cell Biology and Botany** - Methods of Cell Biology - Structure and functions of the eukaryotic cell and its components - The structure of plant tissues and organs, and their functions - Key organisational forms and structural plans of plants - Plant propagation and reproduction (algae, mosses, ferns, seed plants) **Practical exercises in plant cytology and anatomy** - Practical use of the light microscope - Preparation of plant anatomical specimens - Scientific drawing - Knowledge of the organs and tissues of higher plants
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to - sketch and name the fine structure of cells and their components (organelles), as well as explain their respective functions, - to sketch and name tissues, organs and plant architectural plans, and to explain their functions, - interpret the structural plans of plants in ecological and evolutionary contexts, - explain the reproduction and propagation of the various forms of organisation, - identify the structure of plant cells and tissues under a light microscope and produce drawings in accordance with specified scientific criteria, - independently prepare specimens of plant cells and tissues and examine them under a light microscope, and - optimise microscopic techniques for the examination of plant cells and tissues in a targeted manner.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester

9. Recommended academic semester	1st semester
10. Module workload / Number of credit points	Total in hours: 210 of which: 1. Contact hours: 97.5 hours 2. Self-study (including exam preparation/exam): 112.5 hours Credit points: 7

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	General Biology – Cell Biology and Botany	2.5	3	
2	P	Lecture	Lecture on the practical sessions in plant cytology and anatomy	1	2	
3	P	Practical session	Practical sessions on plant cytology and anatomy (10 course days)	3	2	Regular attendance, records (drawings) for each course day [2]

13. Module examination

Competence/Topic/Area	Type of examination	Duration/scope	Date	Contribution to the module mark
General Biology – Cell Biology and Botany, Cytology and Plant Anatomy	Written examination	90 mins	End of the tutorial (midway through the winter semester lecture period)[3]	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[2] If fewer than 80 per cent of the attendance records have been certified/submitted (more than two days of absence), students may not sit the examination.

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-02

1. Name of the module	**Allgemeine Biologie - Zoologie** **General Biology – Zoology**
2. Department / Person responsible	Zoology / Prof. Dr Lena Wilfert
3. Module content	Basic knowledge of general biology and an overview of the fundamental aspects of zoology. - Structure of animal cells, tissues and organisms - Key structural patterns in animals - Animal physiology - Animal behaviour - Overview of animal diversity and their ways of life - Consequences of the loss of biodiversity
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to - reconstruct the organisational plans of the major animal phyla, - carry out and interpret simple preparations and experiments independently.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	1st semester
10. Module workload / Number of credit points	Total in hours: 210 of which: 1. Contact hours: 97.5 hours 2. Self-study (including exam preparation/exam): 112.5 hours Credit points: 7
11. The module is successfully completed once the requirements described in more detail below have been met.	

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Academic achievements
1	P	Lecture	General Biology – Zoology	2.5	3	
2	P	Lecture	Lecture accompanying the practical sessions on animal cytology and anatomy	1	2	
3	P	Practical session	Practical sessions on animal cytology and anatomy (10 course days)	3	2	Regular attendance, reports (drawings) for each course day [2]

13. Module examination

Competence/Topic/Area	Type of examination	Duration/scope	Date	Proportion of module mark
General Biology – Zoology, Cytology and Animal Anatomy	Written examination	90 mins	End of the seminar (End of winter semester, lecture term)[3]	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[2] If fewer than 80 per cent of the attendance records have been certified or submitted (more than two days of absence), students may not sit the examination.

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-03

1. Name of the module	**Ökologie und Evolutionsbiologie** **Ecology and Evolutionary Biology**
2. Department / Responsible	Ecology / Prof. Dr Eva Knop, Prof. Dr Florian Hartig Evolutionary Biology / Prof. Dr Lena Wilfert
3. Module content	Basic knowledge of ecology and nature conservation, as well as evolutionary biology. **Lecture on Ecology** - Fundamental concepts of ecology: organisms, species, niches, and the ecological and physiological adaptations of organisms to their habitats - Population dynamics in space and time - Mechanisms of intra- and interspecific interactions - Earth's ecosystems and biomes in the context of global change - Fundamentals of nature conservation **Lecture on Evolutionary Biology** - The origin and diversification of life, taking into account fundamental mechanisms of evolution - Population genetic principles - The significance of conflict and cooperation in the evolution of complex entities
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the field of ecology** - to define the fundamental ecological relationships at global and local levels, - interpret nature conservation and environmental issues on the basis of ecological research, **in the field of evolutionary biology** - to explain the fundamentals of current thinking on evolution by natural selection and to refute unfounded criticisms of evolutionary theory.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	3 semesters
9. Recommended semester	2nd semester: Ecology 4th semester: Evolutionary Biology
10. Module workload / Number of credit points	Total in hours: 180 of which: 1. Contact hours: 60 hours 2. Self-study (including exam preparation/ exam): 120 hours

	Credit points: 6

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Ecology	2	3	
2	P	Lecture	Evolutionary Biology	2	3	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Ecology	Written exam	60 mins	End of summer semester (lecture term)[2]	50 %
Evolutionary Biology	Written exam	60 mins	End of summer semester (lecture term)	50 %

14. Comments

[1] The information on credit points (CP) is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-04

1. Name of the module	**Formenkenntnis und Systematik von Pflanzen** **Form and Systematics of Plants**
2. Department / Person in charge	Evolution and Systematics of Plants / Prof. Dr Christoph Oberprieler
3. Module content	Basic knowledge of plant morphology and systematics, with a particular focus on the native flora. **Lecture and practical** - Morphology and terminology of angiosperms (Angiospermae) - Characteristics of the most important native plant families - Fields of study in systematic botany (taxonomy, nomenclature, phylogeny, evolutionary biology, biogeography) - Identification of native flowering plants - Characteristic features of the main plant families - Preparing flower diagrams - Creating a herbarium **Field trips** - Applying the knowledge of the main native plant groups acquired during the practical sessions in the wild - Providing background biological knowledge on the ecology of the plants found and their associated plant communities and habitats
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - to identify the 100 most important native flowering plant species, - to identify other members of the native flora using identification guides, - understand and use botanical terminology, - to teach the systematics and ecology of native plants and plant communities, - to be familiar with and describe the fields of work within systematic botany (taxonomy, phylogeny, evolutionary biology, biogeography).
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	2nd semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 67.5 hours

	2. Self-study (including exam preparation/ exam): 82.5 hours Credit points: 5

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP [1]	Academic achievements
1	P	Lecture	Lecture on the practical sessions on plant morphology and systematics	1	2	
2	P	Practical exercise	Plant morphology and systematics	3	2	Regular attendance, notes for each day of the course [2]
3	P	Field trip	Botanical field trips with an ecological focus (2 half-days)	0.5	1	Participation

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Plant Morphology and Systematics	Written examination	60 mins	End of summer semester [3] (lecture term)	30 %
Plant Morphology and Systematics	Practical examination	90 mins	End of summer semester [3] (lecture term)	70 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[2] If fewer than 80 per cent of the attendance records have been certified or submitted (more than two days of absence), students may not sit the examination.

[3] A resit is usually offered within six months of the examination results being announced.

1. Name of the module	**Formenkenntnis und Systematik von Tieren** **Form and Systematics of Animals**
2. Department / Person in charge	Evolution and Systematics of Animals / Prof. Dr Erhard Strohm
3. Module content	Basic knowledge of morphology and systematics, particularly of native fauna. **Lecture and practical** - Key biological phenomena with relevance to ecology, evolutionary biology and behavioural biology, in each case based on the animal group covered in the practical sessions - Identification of native animals - Characteristic features of the most important taxa **Field trips** - Applying the knowledge of the main native animal groups, acquired during the practical sessions, in the wild - Providing background biological knowledge on the systematic classification, ecology, evolutionary biology and behaviour of the animals encountered
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - identify the most important native zoological taxa on the basis of their characteristic features and classify them systematically, - to describe and interpret the ecology, evolutionary biology and behaviour of native animals.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	2nd semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 67.5 hours 2. Self-study (including exam preparation/ exam): 82.5 hours Credit points: 5
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework

1	P	Lecture	Lecture accompanying the practical sessions on the morphology and systematics of animals	1	2	
2	P	Practical exercise	Morphology and classification of animals	3	2	Regular attendance, notes for each day of the course [2]
3	P	Field trip	Zoological field trips with an ecological focus (2 half-days)	0.5	1	Participation

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Morphology and Systematics of Animals	Written examination	90 mins	End of summer semester (lecture term)[3]	100 %[4]

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] If fewer than 80 per cent of the attendance records have been certified or submitted (more than two days of absence), the examination may not be sat.

[3] A resit is usually offered within six months of the examination results being announced.

[4] Marking of the written examination: 50% theoretical component, 50% practical component .

Module BIO-BSc-06

1. Name of the module	**Pflanzen- und Tierphysiologie** **Plant and Animal Physiology**
2. Department / Person in charge	Plant Physiology / Prof. Dr Klaus Grasser Animal Physiology / Prof. Dr Dr Oliver Bosch
3. Module content	**Plant Physiology** Basic knowledge of molecular, cellular and physiological metabolic, developmental and locomotive processes in plants. - Plant Biotechnology - Physiology of Movement - Metabolic Physiology - Developmental physiology **Animal physiology** Basic knowledge of molecular, cellular and physiological processes in animal organs, as well as their interaction in animals and/or humans. - Muscle physiology - Renal physiology - Digestive and excretory processes - Neurophysiology and sensory physiology - Hormonal systems in the animal kingdom - Respiratory and cardiovascular systems Ophthalmology
4. Learning outcomes of the module / Competencies to be acquired	**Plant Physiology** Upon successful completion, students will be able to - explain the principles and applications of plant biotechnology, - illustrate plant movement processes and their regulation, - to deduce the control mechanisms of plant metabolic reactions (e.g. photosynthesis, nutrient assimilation) and their relationship to transport processes, - explain growth and development, as well as their regulation by light and phytohormones. **Animal Physiology** Upon successful completion, students will be able to - to describe the physiology of respiration, - to describe the physiology of the cardiovascular system, - to describe the physiology of digestion and the excretory organs, - to describe the fundamentals of neuroendocrinology and neurophysiology, - to describe the physiology of the sensory organs, - to describe the physiology of the musculoskeletal system, and

	- to integrate the physiological knowledge acquired into a coherent whole, - to apply the physiological knowledge acquired.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter term, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended semester	3rd semester
10. Module workload / Number of credit points	Total in hours: 240 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 150 hours Credit points: 8

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Plant Physiology	3	4	
2	P	Lecture	Animal Physiology	3	4	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Plant Physiology	Written examination	90 mins	Mid-winter term (lecture term)[2]	50 %
Animal Physiology	Written examination	90 mins	End of winter semester (lecture term)[3]	50 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[2] A resit is offered in the second half of the semester (lecture period).

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-07

1. Name of the module	**Neurobiologie, Ethologie und Entwicklungsbiologie** **Neurobiology, Ethology and Developmental Biology**
2. Department / Person in charge	Neurobiology and Ethology / Prof. Dr Inga Neumann
3. Module content	**Lecture on Neurobiology and Ethology** - Functional anatomy of blood vessels supplying the brain, meninges, ventricles, blood-brain barrier - Functional anatomy of brain regions, with a focus on the spinal cord, limbic system, basal ganglia, cortex and hypothalamus - Structure and function of neurons in the mammalian brain - Receptors, enzymes and neurotransmitter systems in mammals - Neurobiological behavioural tests for emotionality and social behaviour in laboratory rodents - Neuropeptides as neuromodulators of the brain and their functions in complex behaviours - Models of psychopathological behaviour - Key neuropharmaceuticals and their mechanisms of action, as well as selected street drugs and their effects - Classical and modern methods of ethology, as well as insights into habitat selection, foraging, territory defence, mate selection, reproduction and rearing of offspring **Lecture on Developmental Biology** - Model organisms in developmental biology - Embryonic development in plants, animals and humans - Significance and function of stem cells and meristems - Cell polarity, cell communication and pattern formation - Post-embryonic organ development in plants - Genetic control of body plans, formation of body axes, significance of homeotic genes in plants and animals - The formation and function of germ cells; fertilisation processes in plants and animals - Comparison of key developmental processes in different animal groups - Application of developmental biology methods in medicine
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the field of neurobiology and ethology** - to explain the ventricles, BHS, cerebral vessels and meninges, - to assign functions to brain regions,

	- describe the physiological functions of neurons in detail, - to identify the cell types and their functions in the brain, - to explain the most important neurotransmitter systems, receptors and enzymes, and their functions, - explain experimental approaches to elucidating the functions of neurotransmitters and neuromodulators, - to describe the mechanisms of action and targets of the most important psychotropic drugs and some street drugs, - to understand classical and modern methods of ethology, - to formulate ethological research questions, - to describe the basic features of animal behaviour and place them in a broader context. **In the field of developmental biology** - to outline, name and distinguish between embryonic stages, germ lines and fertilisation processes, - to explain developmental genetic mutant screens, - to understand classical and modern methods of developmental biology, - to illustrate stem cell niches, - to recognise evolutionary connections in developmental biology, - understand the use of stem cells in research and therapy, and - to carry out an ethical assessment of the application of developmental biology methods in medicine.
5. Entry requirements	
a) Recommended prior knowledge	Module BIO-BSc-06: Lecture on Animal Physiology
b) Compulsory requirements	Modules BIO-BSc-01 and BIO-BSc-02
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	4th semester
10. Module workload / Number of credit points	Total in hours: 180 of which: 1. Contact hours: 60 hours. 2. Self-study (including exam preparation/ exam): 120 hours Credit points: 6
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Neurobiology and Ethology	2	3	
2	P	Lecture	Developmental Biology	2	3	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Neurobiology and Ethology	Written examination	90 mins	End of winter semester [2] (lecture term)	50%
Developmental Biology	Written examination	60 mins	End of winter semester [2] (lecture term)	50%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-08

1. Name of the module	**Genetik** **Genetics**
2. Department / Person responsible	Genetics / Prof. Dr Wolfgang Seufert
3. Module content	**Lecture** - Genomes, chromosomes, genes: organisational structures and variation, origins, centromeres and telomeres, gene classes and families - Regulation of gene expression: chromatin modification and epigenetics, signal-controlled transcription, RNA processing and interference, translation control - Mutations and recombination: types of mutation and their influence on gene expression, mutagenesis, genome editing, DNA repair and recombination - Genetic engineering: Recombinant DNA technology, transgenic organisms, cloning of organisms, gene therapy - Mitosis, meiosis: molecular regulation of the cell division cycle, generation of genetic diversity in meiosis, chromosome segregation in meiosis - Classical genetics: Mendelian mono- and di-hybrid inheritance, sex-linked inheritance, pedigree analysis, gene linkage and mapping, multiple alleles and dominance relationships, genetic interactions (epistasis, complementation, suppression), cytoplasmic inheritance **Practical** Consolidation of the lecture material using exam-relevant questions
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - describe the structure of genetic material and explain the mechanisms governing gene expression, - classify mutations and thereby describe the molecular basis of mutation-related diseases, - explain DNA repair and recombination events - understand the molecular basis of genetic engineering techniques, - explain the processes of cell division and the formation of germline cells, - to link inheritance processes with molecular mechanisms.
5. Entry requirements	
a) Recommended prior knowledge	Module BIO-BSc-10.1: Lecture on the Fundamentals of Molecular Biology and Biochemistry
b) Compulsory prerequisites	Modules BIO-BSc-01 and BIO-BSc-02
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in /	1 semester

Intended duration of the module	
9. Recommended academic semester	4th semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 60 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 5

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Genetics	3	4	
2	P	Exercise to accompany the lecture	Genetics	1	1	

13th module examination

Competence/Topic/Area	Type of examination	Dura-tion/Scope	Date	Proportion of module mark
Genetics	Written exam	90 mins	End of the summer semester [2] (lecture term)	100 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-09

1. Name of the module	**Mikrobiologie** **Microbiology**
2. Department / Person responsible	Microbiology / Prof. Dr Dina Grohmann
3. Module content	**Lecture** - History and fundamental principles of microbiology - Morphology and cytology (e.g. components of a bacterial cell, cell walls, cell appendages, genome organisation, spores, biofilms, etc.) - Growth physiology (molecular basis, cell division, cultivation, growth factors, growth inhibition, sterilisation, antibiotics) - Microbial metabolism (enzymatic reactions, glycolysis, aerobic/anaerobic respiration, fermentation, methanogenesis) - Molecular biology of prokaryotic cells with a focus on the distinctive features of archaea (transcription, translation, CRISPR-Cas, gene transfer) - Viral infections - Fundamentals of biotechnological applications - Fundamentals of bacterial infection and pathogenicity - Fundamentals of the evolution and systematics of prokaryotes **Practical** - Revision of and reflection on lecture content using exam-relevant questions
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - identify key milestones in microbiology, - outline the structure of prokaryotic cells and explain the functions of cellular components (in particular, the differences between bacterial, archaeal and eukaryotic cells), - describe microbial growth and key parameters of cultivation, as well as distinguish between methods for controlling microbial growth, - to describe the fundamental metabolic processes of prokaryotic cells and identify their distinctive features, - to describe the molecular processes within the prokaryotic cell (e.g. transcription, translation, regulation of metabolism), - to explain which factors contribute to the pathogenicity of bacteria, - to name the methods and current state of prokaryote taxonomy and systematics, - to recognise and identify the biotechnological applications of bacteria and archaea.
5. Entry requirements	
a) Recommended prior knowledge	Module BIO-BSc-10.1: Lecture on the Fundamentals of Molecular Biology and Biochemistry
b) Compulsory requirements	Modules BIO-BSc-01 and BIO-BSc-02

6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended semester	4th semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 60 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 5

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Microbiology	3	4	
2	P	Practical session accompanying the lecture	Microbiology	1	1	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Microbiology	Written exam	90 mins	End of summer semester [2] (lecture term)	100 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-10

1. Name of the module	**Molekularbiologie und Biochemie** **Molecular Biology and Biochemistry**
2. Department / Person responsible	Molecular Biology and Biochemistry / Prof. Dr Reinhard Sterner
3. Module content	**Fundamentals of Molecular Biology and Biochemistry** - H_2O, carbon - Structure and properties of amino acids - Methods of protein purification - Structure and function of proteins (myoglobin and haemoglobin as examples) - Enzyme kinetics - Structure of carbohydrates - Structure of lipids and fatty acids - Structure and properties of nucleotides and nucleic acids - Structure of genes, genomes and chromatin - Transcription, regulation of transcription **Biochemistry** - Basic principles of metabolism (anabolism, catabolism, ATP, thermodynamic principles) - Fat breakdown for energy production (lipolysis, β-oxidation) and fatty acid and lipid biosynthesis - Carbohydrate breakdown and synthesis (glycolysis, pentose phosphate pathway, citric acid cycle, respiratory chain, oxidative phosphorylation, gluconeogenesis, glycogen metabolism) - Amino acid breakdown (transamination, urea cycle) - Incorporation of nitrogen into biomolecules, amino acid synthesis - Nucleotide synthesis and degradation - RNA processing and translation - Regulation of translation - Protein degradation (ubiquitin, proteasome) - Hormonal regulation of metabolism and signal transduction (G-protein-coupled receptors, nuclear receptors, kinase-coupled receptors, glucagon and insulin) - Membrane biochemistry (structure and properties of lipid membranes, membrane transport mechanisms, ion channels, membrane and action potentials, ligand-gated ion channels)
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the field of the fundamentals of molecular biology and biochemistry**

	- to describe the chemical structures and properties of amino acids, carbohydrates, lipids and nucleic acids, - to describe the fundamentals of protein structure, protein function and protein purification, - to describe the fundamentals of enzyme function and enzyme kinetics, explain the fundamentals of the transcription of genetic information and its regulation at the molecular level, **in the field of biochemistry** - explain energy production and the regulation of catabolism, as well as their underlying mechanisms, - to explain the basic principles of selected catabolic and anabolic processes, - to describe the regulation of key metabolic reactions, - to explain the fundamentals of translation and its regulation at the molecular level, - to describe the structure and function of membranes as well as transport mechanisms.
5. Entry requirements	
a) Recommended prior knowledge	For module component - No. 1: Module BIO-BSc 14 (General Chemistry) - No. 2: Module BIO-BSc 16 (Organic Chemistry I)
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	annually
8. The module can be taken in / Intended duration of the module	2 semesters
9. Recommended academic semesters	2nd/3rd semester
10. Module workload / Number of credit points	Total in hours: 240 of which: 1. Contact hours: 105 hours 2. Self-study (including exam preparation): 135 hours Credit points: 8
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	**P / WP**	**Teaching method**	**Subject area/topic**	**SWS**	**CP[1]**	**Coursework**
1	P	Lecture	Fundamentals of Molecular Biology and Biochemistry	2	2	
2	P	Lecture	Biochemistry	5	6	

13th module examination				
Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark

Fundamentals of Molecular Biology and Biochemistry	Written examination	60 mins	End of Summer Semester [2] (lecture term)	30 %
Biochemistry	Written examination	60 mins	End of winter semester [2] (lecture term)	70 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-11

1. Name of the module	**Mathematik** **Mathematics**
2. Department / Responsible	Mathematics / Dean of Studies in Mathematics
3. Module content	This module teaches fundamental mathematical skills that are relevant to your degree programme and your future career. The following topics are covered: sets and combinatorics, elementary functions, sequences and series, limits, continuity of functions, differential and integral calculus. An introduction to probability and statistics is also provided as preparation for more advanced courses.
4. Learning Outcomes of the Module / Competencies to be acquired	Upon successful completion, students will be able to apply basic mathematical methods. They can distinguish between and identify elementary functions. They can calculate sequences and series and describe them in terms of their qualitative properties. They are able to analyse real-valued functions and determine their properties. The most common integrals can be calculated. They can name and apply the basic concepts of probability theory and statistics. With regard to the module's content, simple mathematical problems can be analysed and solved independently.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	1st semester
10. Module workload / Number of credit points	Total in hours: 180 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 6
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework

1	P	Lecture	Mathematics for Biologists	2	3	
2	P	Exercises to accompany the lecture	Exercises for the lecture 'Mathematics for Biologists'	2	3	Exercise questions
3	O	Exercise for the lecture	Core exercise for the 'Mathematics for Biologists' lecture	2		

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Mathematics for Biologists	Written examination	60–120 mins[2]	End of the winter semester[3] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[2] The exact duration of the module examination (written exam) will be announced at the start of the course.

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-12

1. Name of the module	**Physik** **Physics**
2. Department / Person responsible	Biophysics / Prof. Dr Remco Sprangers
3. Module content	- Fundamentals - Translational motion - Forces and motion in a force field - Energy and work - Collision - Physics of extended bodies and rotation - Oscillations and waves - Fluid mechanics: hydrostatics and hydrodynamics - Temperature and Heat - Gases - Changes of state and cyclic processes - Kinetic theory of gases - Electrostatics - Electrodynamics - Magnetism - Electromagnetic waves - Geometric Optics - Wave properties of light - Diffraction at slits and gratings - The light microscope
4. Learning outcomes of the module / Skills to be acquired	Students are familiar with the key basic terms, phenomena and concepts of physics. This enables them to follow the reasoning and derivations based on the laws of physics in the natural science subjects. They can solve simple problems in mechanics, electricity and optics.
5. Entry requirements	
a) Recommended prior knowledge	School-level physics
b) Compulsory evidence	-
6. Applicability of the module	BSc in Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	1st semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 60 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 5
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP [1]	Academic achievements
1	P	Lecture	Physics for Biologists	3	4	
2	P	Exercise accompanying the lecture	Physics for Biologists	1	1	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Physics for Biologists	Written exam	60 mins	End of winter semester [2] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-13

1. Name of the module	**Biologische Physik** **Biological Physics**
2. Department / Person responsible	Biological Physics / Prof. Dr Christine Ziegler
3. Module content	- Modern Physics: Fundamentals of quantum mechanics, basic experiments, atomic models, orbital models, nuclear fission, nuclear fusion - Mathematics in spectroscopy, Fourier transform, physical principles - Spectroscopic methods: absorption and spectrometers, UV/VIS/NIR, IR and Raman, fluorescence, CD, mass spectroscopy - 3D structural analysis: electron microscopy, X-ray structural analysis, NMR spectroscopy - Microcalorimetry: DSC, ITC - The lecture 'Introduction to the Practical Course' explores the theoretical foundations of the experiments in greater depth.
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to understand biologically relevant physical concepts and methods. In addition, the module provides a basic understanding of spectroscopic and dynamic methods.
5. Entry requirements	
a) Recommended prior knowledge	School-level physics
b) Compulsory prerequisites	Module BIO-BSc-12 and module part no. 13.1 are prerequisites for module part no. 13.3
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	2 semesters
9. Recommended semester	2nd and 3rd semesters
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 75 hours 2. Self-study (including exam preparation/ exam): 75 hours Credit points: 5
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Sem.	Coursework
1	P	Lecture	Biological Physics	2	3	2. (Summer Semester)	

2	P	Lecture	Physics for Biologists – Introduction to the Practical Course	1	1	3. (Winter semester)	
3	P	Practical Course	Physics for Biologists	2	1	3. (Winter semester)	Regular attendance, notes for each day of the course

13. Module examination

Competence/Topic/Area	Type of examination	Duration/scope	Date	Proportion of module mark
Biological Physics	Written exam	60 mins	End of summer semester [2] (lecture term)	100 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-14

1. Name of the module	**Allgemeine Chemie** **General Chemistry**
2. Department / Person responsible	Chemistry / Dean of Studies for Chemistry
3. Module content	Atomic theory, empirical gas laws and kinetic theory of gases, microscopic structure of matter: elementary particles, atoms, wave-particle duality and the quantum theory approach to describing electrons in atoms, discussion of the results for simple single-particle systems, single- and multi-electron atoms, the organising principle of the periodic table of elements, radioactive decay. Fundamentals of stoichiometry, chemical equilibrium and the law of mass action, dissolution processes and the solubility product, acids and bases: definitions and quantitative treatment of acid–base equilibria and buffer systems, electrochemical potential, electrochemical series, redox and complex equilibria. Chemical bonding: ionic compounds, metals, covalent bonding, electronegativity, polarity and dipole moment, description of simple molecules using molecular orbital (MO) theory, spatial structure of molecules, weak bonding forces.
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to distinguish between empirical descriptions and theoretical approaches in the natural sciences. Students will understand the necessity of quantum mechanics for describing the atomic structure of matter and will be able to apply its findings to the description of chemical bonds. They will understand the relationship between the electronic structure and the spatial structure of chemical compounds. They will also be able to apply stoichiometric calculations in the context of reaction sequences and equilibrium processes in solution.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory prerequisites	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	1st semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 60 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 5

11. The module is successfully completed once the requirements set out in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	General Chemistry for Biologists	2	3	
2	P	Practical session accompanying the lecture	General Chemistry for Biologists	2	2	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
General Chemistry for Biologists	Written examination	120 mins	End of winter semester [2] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-15

1. Name of the module	**Anorganische Chemie** **Inorganic Chemistry**
2. Department / Responsible	Chemistry / Dean of Studies for Chemistry
3. Module content	Quantitative section Quantitative determinations of known ions in aqueous solution are carried out. Various wet chemical analytical methods are used, such as titrations (e.g. acid-base and redox titrations) and determinations involving simple apparatus or instruments (e.g. gravimetry, quantitative electrolysis). In addition, molar concentrations are adjusted according to specified parameters (e.g. buffer systems). In this way, the principles of reactions in aqueous solution – such as dissociation equilibria, pH, complex formation constants and solubility products – are taught using practical examples. Qualitative section Through simple chemical experiments and qualitative chemical analyses, students acquire knowledge of substances, learn about the reaction behaviour of selected cations and anions, and learn how to handle chemicals safely. The theoretical and experimental treatment of important chemical fundamentals – such as solubility and solubility product (metathesis reactions, precipitation reactions), pH (dependencies, buffer systems), dissociation equilibria, complex formation constants and redox reactions – is introduced through simple hands-on experiments and then applied in the separation process.
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to formulate simple reaction equations and recognise the relationships between chemical equilibrium and ongoing reactions. They are able to apply simple theoretical concepts in the context of practical problems. They are able to set up simple glassware set-ups and carry out basic chemical reactions according to instructions. In addition, they can distinguish between common laboratory chemicals in terms of key properties and assess their reactivity.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	Module BIO-BSc-14
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester

9. Recommended academic semester	2nd semester
10. Module workload / Number of credit points	Total in hours: 150 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 60 hours Credit points: 5

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Practical course	Inorganic Chemistry	4	3	Regular attendance, seminars and notes for each day of the course
2	P	Seminar on the practical course	Inorganic Chemistry	2	2	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Inorganic Chemistry	Written examination	120 mins	End of summer semester [3] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] The colloquia cover the theory behind the experiment, its experimental implementation and, above all, safety aspects. Students must pass the colloquium in order to begin the experiment. The colloquium is ungraded.

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-16

1. Name of the module	**Organische Chemie I** **Organic Chemistry I**
2. Department / Person responsible	Chemistry / Dean of Studies for Chemistry
3. Module content	- Principles of Organic Chemistry: nomenclature, structure and bonding, functional groups, stereoisomerism, delocalisation, mesomerism, catalysis - Relationship between organic compound classes, characteristic functional groups and their reactivity: alkanes/radical substitution, alkenes/electrophilic addition, haloalkanes/nucleophilic substitution, aromatics/electrophilic substitution, carbonyl compounds/nucleophilic acyl substitution and addition, oxidations/reductions - Introduction to bioorganic chemistry: carbohydrates, proteins/enzymes/coenzymes, nucleic acids
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be familiar with the organic compound classes and their specific properties, the respective functional groups and their fundamental reaction mechanisms and influencing parameters, the principles of stereoisomerism and stereoselectivity, as well as the most important bioorganic compound classes and their significance in chemical biology. Students will be able to use the exemplary knowledge they have acquired to classify organic compounds with which they are unfamiliar. Based on the structure, students will be able to make reasonable predictions regarding the properties of these compounds as well as their reactivity. For the synthesis of simple organic compounds, students will be able to propose and evaluate various routes.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory prerequisites	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Summer semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	2nd semester
10. Module workload / Number of credit points	Total in hours: 180 of which: 1. Contact hours: 75 hours 2. Self-study (including exam preparation/exam): 105 hours Credit points: 6
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Organic Chemistry I	4	5	
2	P	Seminar accompanying the lecture	Organic Chemistry I	1	1	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Organic Chemistry I	Written examination	120 mins	End of the summer semester [2] (lecture term)	100 %

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-17

1. Name of the module	**Organische Chemie II** **Organic Chemistry II**
2. Department / Responsible	Chemistry / Dean of Studies for Chemistry
3. Module content	**Lecture and seminar** - Deepening and broadening knowledge of organic reaction mechanisms - New reaction mechanisms: rearrangements, cycloadditions - Reactions of preparative importance in theory - Principles of regio- and stereoselective syntheses - Planning simple multi-step syntheses **Practical work** - Synthesis of organic molecules of low to medium complexity - Systematic learning of fundamental laboratory methods and working techniques, such as sublimation, distillation, extraction or chromatography - Planning experiments in accordance with departmental regulations - Safe handling and proper disposal of hazardous substances - Analytical monitoring of reaction progress using simple techniques and characterisation of reaction products using standard analytical techniques, such as determination of melting point and refractive index, IR and NMR spectroscopy - Recording of experimental procedures and results
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to recognise the mechanisms of organic chemical reactions. Students can use the exemplary knowledge they have acquired to classify organic chemical reactions with which they are unfamiliar. Based on the structure of compounds, students can make informed suggestions regarding the properties of these compounds, their reactivity and their targeted conversion into new compounds. For the synthesis of simple organic compounds, students can propose and evaluate various routes, including multi-step ones. Upon completion of the module, students will be able to independently plan and safely carry out organic syntheses, including multi-step ones, following specialist instructions. To this end, they will have mastered and be able to apply fundamental laboratory and analytical techniques, as well as the handling and safe disposal of hazardous substances. Students can analyse reaction products using standard methods.
5. Entry requirements	
a) Recommended prior knowledge	-

b) Compulsory evidence	For module component no. 3: Module BIO-BSc-16
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter term, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended semester	3rd semester
10. Module workload / Number of credit points	Total in hours: 270 of which: 1. Contact hours: 150 hours 2. Self-study (including exam preparation/exam): 120 hours Credit points: 9

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Organic Chemistry II	3	4	
2	P	Seminar accompanying the lecture	Organic Chemistry II	2	2	
3	P	Practical	Organic Chemistry	5	3	Regular attendance, seminars [2] and notes for each day of the course

13. Module examination

Competence/Topic/Area	Type of examination	Duration/scope	Date	Proportion of module mark
Organic Chemistry II	Written examination	120 mins	End of winter semester [3] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] The colloquia cover the theory behind the experiment, its experimental implementation and, above all, safety aspects. Students must pass the colloquium in order to begin the experiment. The colloquium is ungraded.

[3] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-18

1. Name of the module	**Physikalische Chemie** **Physical Chemistry**
2. Department / Person responsible	Chemistry / Dean of Studies for Chemistry
3. Module content	Physical chemistry deals with concepts that lead to a better understanding of the macroscopic properties of matter. Thermodynamics: behaviour of ideal and real gases, principle of state functions (total differential), heat and work, laws of thermodynamics, analysis of the energetics of processes (internal energy and enthaCPy), spontaneity of processes (cyclic processes, heat engine, entropy), states of equilibrium (chemical potential), phase equilibria of pure substances (melting, evaporation), colligative properties of mixtures (freezing point depression, osmotic pressure, Raoult's and Henry's laws), equilibrium of chemical reactions and the law of mass action. Interfacial chemistry: surface tension, capillary pressure, contact angle, adsorption processes, formation of monomolecular layers. Electrochemistry: galvanic and electrolytic cells, electrochemical series, Nernst equation, Faraday's laws, corrosion, fuel cells. Kinetics: differential and integral rate equations for simple and complex reactions, temperature dependence of reaction rate (Arrhenius equation), activation energy. In the practical sessions accompanying the lecture, the knowledge acquired in the lecture is applied to solve specific physico-chemical problems.
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to explain the concepts of chemical thermodynamics, electrochemistry and interfacial chemistry, as well as the kinetics of chemical reactions, and apply them in a problem-oriented manner. Students can explain various everyday phenomena using physico-chemical quantities and perform specific calculations relating to them. The module equips students with the scientific mindset of physical chemistry and thus contributes to the identification and resolution of subject-specific problems.
5. Entry requirements	
a) Recommended prior knowledge	Modules BIO-BSc-11 and BIO-BSc-14
b) Compulsory requirements	-
6. Applicability of the module	BSc Biology

7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	3rd semester
10. Workload for the module / Number of credit points	Total in hours: 120 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 30 hours Credit points: 4

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Physical Chemistry	2	3	
2	P	Practical session accompanying the lecture	Physical Chemistry	1	1	
3	P	Tutorial	Tutorial for the Physical Chemistry lecture	3		

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Physical Chemistry	Written examination	120 mins	End of winter semester [2] (lecture term)	100%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-19

1. Name of the module	**Praxismodul** **Practical Module**
2. Subject area / Responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	**Practical exercise in plant physiology and biochemistry** - Analysis of certain physiologically relevant mechanisms, such as the effects of phytohormones and light, and photosynthesis - Some biochemical techniques, such as chromatography and electrophoresis **Practical session in Animal Physiology** Consolidation of theoretical knowledge from the Animal Physiology lecture through illustrative experiments - Sensory Physiology - Cardiac function, blood pressure - Neuroendocrinology **Practical Exercise in Genetics** - Experiments in mutation analysis - Complementation and gene linkage - Recombination-mediated gene deletion - Protein expression and DNA fingerprint analysis - Methods: Transformation of *E. coli* and *S. cerevisiae*, DNA preparation, restriction digestion, PCR, agarose gel electrophoresis, SDS-PAGE, microscopy **Practical session in microbiology** - Fundamentals of microbiological techniques - Sterile working - Staining techniques - Use of the phase-contrast microscope - Experiments on the enrichment, isolation and characterisation of microorganisms - Simple physiological tests - Assessments of bacterial growth, effects of antibiotics and bacteriophages - Genetic manipulation of E. coli, including sequence-specific gene modification using the Cas9 nuclease - Gene inactivation using CRISPR-Cas - Synthetic microbiology **Practical session on evolutionary biology and molecular ecology** An introduction to the approaches, research questions and methods of modern organismic biology, illustrated by current research examples. Examples of experimental topics: - Determining the structure of plant populations and insect colonies - Analysis of ecological processes using molecular methods

	- Interactions between animals and plants - Phylogenetic reconstruction - Identification of organisms using molecular markers - Chemical communication - A range of methods from modern organismic biology, e.g.: polymerase chain reaction - Gene sequencing - "Bar-coding" - Gas chromatography - Mass spectrometry **Practical session in Physical Chemistry** Consolidation of the theoretical knowledge imparted in the lecture 'Physical Chemistry for Biologists' through guided experimental work. The focus is on learning how the equipment and methods used work, assessing the potential hazards specific to each experiment, and applying the principles of good scientific practice when analysing measurement data (experiment reports). The practical session comprises the following eight experiments: - Determination of the heat of combustion of basic biological building blocks and the heat of solution of salts. - Determination of the molar masses of compounds by analysing the freezing point depression of solutions. - Analysis of interfacial phenomena and monomolecular layers. - Optical methods for determining concentration. - Structural characterisation by dynamic light scattering. - Analysis of galvanic cells and fuel cells - Conductivity of electrolyte solutions as an important analytical method. - Investigation of biologically relevant buffer systems using the glass electrode.
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the field of plant physiology and biochemistry** - to determine photosynthetic activity experimentally, - to experimentally demonstrate the action of phytohormones, - to investigate plant transport processes, - to apply key biochemical separation methods (electrophoresis, chromatography), - to characterise the biochemical properties of enzymes, - to prepare solutions and reaction mixtures, to produce biochemical extracts, and to use pipettes and other laboratory instruments, - and to evaluate and interpret experimental results obtained independently.

	in the field of animal physiology - to carry out comparative physiological experiments on vision in insects and humans, - to carry out physiological experiments on the circulatory system in humans, - to carry out physiological experiments on cardiac function in vertebrates, - to carry out physiological experiments on neuroendocrinology in vertebrates, - to statistically evaluate and discuss experimental results. **In the field of genetics:** - apply fundamental techniques of molecular genetics such as DNA cloning and polymerase chain reaction (PCR), - to describe the formation, repair and detection of mutations, - to analyse complementation and gene linkage, - to design expression constructs and recombination-mediated genetic modifications, - detect human DNA polymorphisms, **in the field of microbiology** - to transfer and purify bacterial cultures aseptically, - to carry out and evaluate simple classifications of bacteria using physiological tests in accordance with scientific criteria, - independently prepare bacterial culture slides for phase-contrast microscopy and differential staining, and examine them under a microscope. - to apply fundamental techniques of molecular genetics such as the polymerase chain reaction (PCR), agarose gel electrophoresis, DNA cloning and plasmid transformation, - to understand and apply molecular aspects of microbiology. **in the field of evolutionary biology and molecular ecology,** - to match appropriate investigative methods to the various research questions in molecular ecology and evolutionary biology, apply the methods learnt to their own research questions in broad terms **in the field of physical chemistry** - to apply various physico-chemical measurement methods and critically analyse the experimental data obtained from them, - to evaluate the data they have generated themselves using the theoretical models they have learnt and to

	perform calculations to address specific research questions.
5. Entry requirements	
a) Recommended prior knowledge	**For the module components:** Nos. 1, 2, 3, 4: Module BIO-BSc-10.1: Lecture on the Fundamentals of Molecular Biology and Biochemistry No. 6: Modules BIO-BSc 11, BIO-BSc 14, BIO-BSc 18
b) Compulsory evidence of completion	**For the respective module component:** No. 1: Module BIO-BSc-06: Lecture on Plant Physiology No. 2: Module BIO-BSc-06: Lecture on Animal Physiology No. 3: Module BIO-BSc-08 No. 4: Module BIO-BSc-09 No. 5: Modules BIO-BSc-01, 02, 04 and 05
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter/Summer semesters, annually
8. The module can be taken in / Intended duration of the module	2 semesters
9. Recommended academic semester	3rd/4th/5th semester
10. Module workload / Number of credit points	Total in hours: 270 of which: 1. Contact hours: 180 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 9
11. The module is successfully completed once the requirements described in more detail below have been met.	

12. Module components [1]

No.	P / WP	Teaching method	Subject area/Topic	SWS	CP[2]	Coursework
1	WP	Practical session	Plant Physiology and Biochemistry	4	3	Regular attendance, portfolio
2	WP	Practical session	Animal physiology	4	3	Regular attendance, portfolio
3	WP	Practical session	Genetics	4	3	Regular attendance, written examination
4	WP	Practical session	Microbiology	4	3	Regular attendance, written examination
5	WP	Practical session	Evolutionary Biology and Molecular Ecology	4	3	Regular attendance, portfolio
6	WP	Practical session	Physical Chemistry	4	3	Regular attendance, portfolio

13th module examination
This module is not graded.
14. Comments

[1] Students must select at least three compulsory elective placements; of these, at least one must be from the pair comprising compulsory elective placements No. 1 and 2, and at least one from the pair comprising compulsory elective placements No. 3 and 4.

[2] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

Module BIO-BSc-21

1. Name of the module	**Schlüsselkompetenzen** **Key Competences**
2. Subject area / Person responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	**Seminars** - Presentation of a research-based topic from the field of biology **Career-oriented events** - Overview of various career paths, e.g. through attendance at a careers fair or careers day **Experimental design** - Scientific methodology - Various experimental designs and their advantages and disadvantages - Possibilities and limitations of statistical conclusions - Rules for conducting and evaluating experiments **Digital image processing** - What is a digital image and how is it created? - What information does digital image data contain? - Processing digital images using open-source programmes - Permitted and prohibited processing steps for scientific data - Quantification of image content - Creating an illustration for a scientific text (e.g. a Bachelor's thesis) **Academic writing** - Function and format of scientific publications - Scientific figures and captions - Stylistic options - Practical approaches to writing academic papers **Current Topics in Molecular Biology** - Modern methods in molecular biology (CRISPR, -omics, cryo-EM) - Current topics (e.g. RNA modifications, the microbiome, protein design) - Examples of applications (e.g. gene therapy, RNA therapeutics)
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the area of seminars** - to structure scientific content on the basis of specified literature and present it in the form of a lecture, - to independently research and evaluate various sources on specific academic topics, and to analyse

	and discuss the content of other seminar presentations. **In the area of experimental design** - to understand and develop various basic experimental designs based on the scientific method (i.e. hypothesis-driven), and - to take ethical principles into account when conducting and evaluating experiments, in accordance with good scientific practice. **in the field of digital image processing** - to analyse and quantify digital image data from various sources, - to compile figures for scientific publication from raw digital data, - to carry out image analysis and image processing critically in accordance with scientific criteria, - to apply sound scientific principles to image processing and presentation. **in the field of academic writing** - Understanding the information structure of scientific papers. **in the area of current topics in molecular biology** - to describe modern methods in molecular biology, - to critically discuss current topics and examples of applications in molecular biology.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter/Summer semesters, annually
8. The module can be taken in / Intended duration of the module	2 semesters
9. Recommended academic semester	4th/5th/6th semester
10. Module workload / Number of credit points	Total in hours: 390 of which: 1. Contact hours: 165 hours 2. Self-study (including exam preparation/ exam): 225 hours Credit points: 13

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[3]	Coursework
1	P	Seminar	Biology Seminar I [1]	2	2	Seminar presentation
2	P	Seminar	Biology Seminar II [1]	2	2	Seminar presentation

3	P		Vocational qualification modules [2]	3	3	Active participation
4	P	Lecture	Design and evaluation: experimental design, digital image processing, academic writing	2	3	Portfolio
5	P	Lecture	Current Topics in Molecular Biology	2	3	Portfolio

13th module examination

This module is not marked.

14. Comments

[1] Students may choose from the range of seminars on offer.

[2] Students may choose from the range of professionally qualifying courses on offer. Among other things, career days and visits to trade fairs in the natural sciences may be credited at 1 CP each, although a maximum of two career days and/or trade fair visits may be credited in total.

[3] The information on credit points (CP) serves solely to calculate the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

Module BIO-BSc-22

1. Name of the module	**Statistik und Bioinformatik** **Statistics and Bioinformatics**
2. Discipline / Person responsible	Statistics / Prof. Dr Florian Hartig Bioinformatics / Prof. Dr Till Rudack
3. Module content	**Statistics** - Univariate and multivariate descriptive statistics - Hypothesis testing - Maximum likelihood - Bayesian statistics - Regression (including multiple regression and GLM) - ANOVA - Causality in statistics - Introduction to machine learning - Experimental design All methods are covered both theoretically and in terms of their practical application in R. **Bioinformatics** - Bayesian methods - Theory and applications of pairwise sequence alignment - Creating and analysing multiple sequence alignments - Use of Markov chains and hidden Markov models - Phylogenetic methods - Introduction to Python - 3D protein structure prediction
4. Learning outcomes of the module / skills to be acquired	Upon successful completion, students will be able to **in the field of statistics** - understand the fundamental concepts of statistics and machine learning, - to present and analyse collected data in an appropriate manner, - to test hypotheses or causal relationships using appropriate statistical tests or regression analyses, - and to incorporate statistical expertise into experimental design. **In the field of bioinformatics** - to use sequence alignment methods for biological problems, - to assess the relevance of the results, - to use biologically relevant databases, - to gain a fundamental understanding of bioinformatics algorithms.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter semester, annually
8. The module can be taken in / Intended duration of the module	1 semester

9. Recommended academic semester	5th semester
10. Module workload / Number of credit points	Total in hours: 180 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 6

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[1]	Coursework
1	P	Lecture	Statistics and Bioinformatics	4	4	
2	P	Exercise accompanying the lecture	Seminar for the 'Statistics and Bioinformatics' lecture	2	2	Exercise questions

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Statistics	Written exam	60 mins	End of winter semester [2] (lecture term)	50%
Bioinformatics	Written exam	60 mins	End of winter semester [2] (lecture term)	50%

14. Comments

[1] The information on credit points is provided solely for the purpose of calculating the course's contribution to the total workload of the module. Credit points are only awarded upon passing the module examination.

[2] A resit is usually offered within six months of the examination results being announced.

Module BIO-BSc-23

1. Name of the module	**Spezialisierungsmodul - Vorlesungen** **Specialisation Module – Lectures**
2. Subject area / Responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	- In-depth study of a specific biological topic.
4. Learning Outcomes of the Module / Competencies to be acquired	Upon successful completion, students will be able to analyse new scientific research and scientific controversies within a specialist field.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence	-
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter and Summer semesters, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	5th/6th semester
10. Module workload / Number of credit points	Total in hours: 270 of which: 1. Contact hours: 90 hours 2. Self-study (including exam preparation/ exam): 180 hours Credit points: 9

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[2]	Coursework [3]
1	P	Lecture	Specialised Biology Lecture I [1]	2	3	Written or oral examination
2	P	Lecture	Specialised Biology Lecture II[1]	2	3	Written or oral examination
3	P	Lecture	Specialised lecture in biology or a non-biological subject III[1]	2	3	Written or oral examination

13th module examination

This module is not graded.

14. Comments

[1] Students may choose from the range of specialist biology lectures on offer.

[2] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[3] The form of assessment will be announced at the start of the lectures.

Module BIO-BSc-24

1. Name of the module	**Spezialisierungsmodul - Praktika** **Specialisation Module – Practical Courses**
2. Subject area / Responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	- In-depth study of a specific biological topic - Development of practical skills in the laboratory
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to work independently in a research-oriented manner and will have mastered fundamental practical laboratory skills as well as methods of data collection and analysis.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory evidence of prior learning	Modules BIO-BSc-01 to 05, BIO-BSc-11, BIO-BSc-12 and BIO-BSc-14 to 16
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter and Summer semesters, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	5th/6th semester
10. Module workload / Number of credit points	Total in hours: 360 of which: 1. Contact hours: 270 hours 2. Self-study (including exam preparation/ exam): 90 hours Credit points: 12

11. The module is successfully completed once the requirements described in more detail below have been met.

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP[2]	Coursework [3]
1	P	Work placement	Project Placement I[1]	9	6	Report and/or presentation
2	P	Work placement	Project Placement II[1]	9	6	Report and/or presentation

13. Module examination

This module is not graded.

14. Comments

[1] Students may choose from the range of project placements on offer.

[2] The information on credit points is provided solely for the purpose of calculating the course's contribution to the module's total workload. Credit points are only awarded upon passing the module examination.

[3] The number and form of the coursework assignment(s) will be announced at the start of each course.

Module BIO-BSc-25

1. Name of the module	**Forschungsmodul** **Scientific Module**
2. Discipline / Responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	- In-depth study of a specific biological topic - Development of practical skills in the laboratory - Presentation of a research-based topic from the field of biology
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - work independently in a research-oriented manner, - to organise academic content on the basis of specified literature and present it in the form of a lecture, - to independently research and evaluate various sources on specific academic topics, - to analyse and discuss the content of the other seminar presentations.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory requirements	At least 132 CP, including the successful completion of the following modules: - BIO-BSc-01 to 06, - at least three modules from BIO-BSc-07 to 10, - BIO-BSc-11 to 18, - BIO-BSc-24
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter/Summer semesters, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	6th semester
10. Module workload / Number of credit points	Total in hours: 360 of which: 1. Contact hours: 285 hours 2. Self-study (including exam preparation/ exam): 75 hours Credit points: 12
11. The module is successfully completed once the requirements described in more detail below have been met.	

12. Module components

No.	P / WP	Teaching method	Subject area/topic	SWS	CP	Course credits [2]
1	P	Work placement	Research placement [1] (6 weeks) with seminar	19	12	Seminar presentation and/or report

13. Module examination

The module is not graded.

14. Comments
[1] The research placement is undertaken in a working group within the Faculty of Biology and Pre-clinical Medicine in preparation for the Bachelor's thesis.
[2] The number and form of the coursework requirements will be announced at the start of the course.

Module BIO-BSc-26

1. Name of the module	**Bachelorarbeit** **Bachelor's Thesis**
2. Discipline / Responsible	Interdisciplinary / Dean of Studies in Biology
3. Module content	- In-depth study of a specific biological topic - Development of practical laboratory skills - Presentation of a research-based topic from the field of biology
4. Learning outcomes of the module / Competencies to be acquired	Upon successful completion, students will be able to - work independently in a research-oriented manner, - to structure academic content on the basis of specified literature and present it in the form of a lecture, - to independently research and evaluate various sources on specific academic topics, - analyse and discuss the content of other seminar presentations.
5. Entry requirements	
a) Recommended prior knowledge	-
b) Compulsory requirements	At least 132 CP, including the successful completion of the following modules: - BIO-BSc-01 to 06, - at least three modules from BIO-BSc-07 to 10, - BIO-BSc-11 to 18, - BIO-BSc-24
6. Applicability of the module	BSc Biology
7. Frequency of the module	Winter/Summer semesters, annually
8. The module can be taken in / Intended duration of the module	1 semester
9. Recommended academic semester	6th semester
10. Module workload / Number of credit points	Total in hours: 360 The amount of contact time and self-study depends on the specific topic and should be discussed with the supervisor where necessary. Credit points: 12
11. The module is successfully completed once the requirements described in more detail below have been met.	
12. Module components	

No.	P / WP	Teaching method	Subject area/topic	SWS	CP	Course credits
1	P		Bachelor's Thesis	22	10	
2	P		Seminar	2	2	

13th module examination

Competence/Topic/Area	Type of examination	Duration/Scope	Date	Proportion of module mark
Bachelor's Thesis	Bachelor's Thesis	10 weeks[1]	6th semester	70%
Bachelor's Thesis	Seminar presentation	max. 60 mins[2]	Completion of the Bachelor's thesis	30%
14. Comments				
[1] The length of the Bachelor's thesis depends on the specific topic and, where applicable, must be agreed with the supervisor. [2] Presentation of the Bachelor's thesis in a seminar talk followed by a discussion.				