Module catalogue
Bachelor of Science Biology
valid from WS 20/21

(As modified by the resolution of May 28, 2020)

Legend:

C = Compulsory
CE = Constrained elective
CHs = Credit hours (1 CH = 45 min/ per week in a semester),
CP = Credit point (1 CP = 25-30 h workload)
L = Lecture
E = Exercise class

Module BIO-BSc-01

1. Module title	**General Biology – Cell Biology and Botany**
2. Person responsible	Prof. Dr. Thomas Dresselhaus
3. Module contents	Basics of general and molecular cell biology, and botany **Lecture in Cell Biology and Botany** - methods in cell biology - structure and function of the eukaryotic cell and its components - structure of plant tissues, plant organs and their functions - basic organizational forms and construction plans of plants - reproduction in plants (algea, moss, ferns, seed plants) **Exercise Class in the Cytology and Anatomy of Plants** - how to use a light microscope - creating plant anatomical preparations - scientific drawing - knowledge of organs and tissues of higher plants
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - draw and specify the microstructure of cells and their components (organelles), and outline their functions, - draw and specify tissue, organs and construction plans of plants, and outline their functions, - interpret the construction plans of plants in ecological and evolutionary contexts, - explain the proliferation and reproduction of different organizational forms, - identify the structure of plant cells and tissues under the light microscope and prepare drawings according to given scientific criteria, - prepare anatomical specimens of plant cells and tissues by themselves and examine them under the light microscope, - optimize targeted microscopic methods to examine plant cells and tissue.
5. Prerequisites for participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	1st semester
10. Workload/ Credit Points	Total hours: 190 comprising: 1. Attendance: 70 hours 2. Independent study including exam preparation:120 hours Credit points: 7

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	General Biology – Cell Biology and Botany	2.5	3	
2	C	Lecture	Lecture for the exercise class in cytology and anatomy of plants	1	2	
3	C	Exercise	Exercise class in the cytology and anatomy of plants (10 days)	3	2	Attendance; report (drawings) on every day of the course[2]

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
General Biology – Cell Biology and Botany; Cytology and Anatomy of Plants	written exam	90 min	end of course (middle of winter semester)[3]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] With less than 80% of the reports (more than two absent days) access to the written exam is not allowed.

[3] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-02

1. Module title	**General Biology - Zoology**
2. Person responsible	Prof. Dr. Jürgen Heinze
3. Module contents	Basics of general biology and overview over the basic aspects of zoology. - structure of animal cells, tissue and organs, - basic construction plans of animals, - physiology of animals, - behavior of animals, - overview over the diversity of animals and their ways of living.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to explain the structure of important animal groups, and possess the basics which enable them to follow subsequent courses in higher semesters, - conduct and interpret basic preparations and experiments independently.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	1st semester
10. Workload/ Credit Points	Total hours: 190 comprising: 1. Attendance: 70 hours 2. Independent study including exam preparation: 120 hours Credit Points: 7

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	General Biology – Zoology	2.5	3	
2	C	Lecture	Lecture for the exercise class in cytology and anatomy of animals	1	2	
3	C	Exercise	Exercise class in cytology and anatomy of animals (10 days)	3	2	Attendance; report (drawings) on every day of the course[2]

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
General Biology – Zoology, Cytology and Anatomy of Animals	written exam	90 min	end of course (end of winter semester)[3]	100%
13. Notes				
[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module. [2] With less than 80% of the reports (more than two absent days) access to the written exam is not allowed. [3] A second written exam is offered in the subsequent semester break as a retake.				

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-03

1. Module title	**Ecology and Evolutionary Biology**
2. Person responsible	Prof. Dr. Peter Poschlod
3. Module contents	Basics of ecology and nature conservation, and evolutionary biology. **Lecture in Ecology** - factors controlling global and local species diversity - zonobiomes of the earth and their climatic characteristics - ecological and physiological adaptations of organisms within their habitat - intra and interspecific interactions - the ecological effects and consequences of climatic change and changing land utilization for nature conservation and the ethical aspects of such changes - basics of nature conservation **Lecture in Evolutionary Biology** - formation and diversification of life considering basic mechanisms of evolution - basics of population genetics - importance of conflict and cooperation for the evolution of complex units
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able **in the field of ecology** - to define the basic ecological relationships on the global and local level, - to interpret nature conservational and environmental problems on the basis of ecological research, **in the field of evolutionary biology** - to demonstrate the basics of today's perception of evolution due to natural selection and dismantle non-objective criticism of evolution.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	2nd semester
10. Workload/ Credit Points	Total hours: 160 comprising: 1. Attendance: 45 hours 2. Independent study including exam preparation: 115 hours Credit Points: 6
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Ecology	2	3	
2	C	Lecture	Evolutionary Biology	2	3	

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Ecology	written exam	60 min	end of summer semester[2]	50 %
Evolutionary Biology	written exam	60 min	end of summer semester[2]	50 %

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-04

1. Module title	**Form and Systematics of Plants**
2. Person responsible	Prof. Dr. Christoph Oberprieler
3. Module contents	Basics of forms and systematics of plants, especially of indigenous flora. **Lecture and Exercise Class** - morphology and terminology of angiosperms - characteristics of the most important indigenous plant families - fields of work for systematic botany (taxonomy, nomenclature, phylogeny, evolutionary biology, biogeography) - determination of indigenous angiosperms - recognition of the characteristic traits of the most important plant families - drawing of a floral diagram - preparation of a herbarium **Excursions** - implementation of the knowledge gained in the exercises about the most important indigenous groups of plants outdoors - transfer of basic biological background knowledge about the ecology of the plants found at the excursion and the associated plant communities and habitats.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - specify the 100 most important indigenous angiosperms, - determine further representatives of the indigenous flora by using identification literature, - understand and use botanical terminology, - to convey the systematics and ecology of indigenous plants and plant communities, - prepare floral diagrams, - prepare a herbarium, - know and outline the working fields of systematic botany (taxonomy, evolutionary biology, biogeography).
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Module BIO-B.Sc.-01
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	2nd semester

10. Workload/ Credit Points	Total hours: 130 comprising: 1. Attendance: 50 hours 2. Independent study including exam preparation: 80 hours Credit Points: 5

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Form and Systematics of Plants	1	2	
2	C	Exercise	Form and Systematics of Plants (10 course days)	2.5	2	attendance; report (drawings) on every day of the course[2]; herbarium
3	C	Excursion	Botanical excursions (2 half days)	0.5	1	attendance of both excursions

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Form and systematics of plants	written exam, practical examination (herbarium, plant recognition, plant identification)	90 min 90 min	end of summer semster[3]	30 % written exam 20 % herbarium 20 % plant recognition (recognize plants without identification) 30 % plant identification

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] With less than 80% of the reports (more than two absent days) access to the written exam is not allowed.

[3] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-05

1. Module title	**Form and Systematics of Animals**
2. Person responsible	Prof. Dr. Erhard Strohm
3. Module contents	Basics of form and systematics, especially of the indigenous fauna. **Lecture and Exercise Class** - important biological phenomena with ecological, evolutionary and behavioral aspects, of the animal groups discussed in the exercises - determination of indigenous animals - recognition of the characteristic features of the most important taxa. **Excursions** - implementation of the knowledge gained in the exercises about the most important indigenous groups of animals outdoors - transfer of basic biological background knowledge about the systematics, ecology, evolutionary biology and behavior of the animals found at the excursion
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - identify and classify the most important indigenous zoological taxa by their characteristic features - understand and use zoological terminology, - demonstrate and interpret the ecology, evolutionary biology and behavior of indigenous animals.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Module BIO-BSc-02
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	2nd semester
10. Workload/ Credit Points	Total hours: 130 comprising: 1. Attendance: 50 hours 2. Independent study including exam preparation: 80 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Form and Systematics of Animals	1	2	
2	C	Exercise	Form and systematics of animals (10 course days)	2.5	2	Attendance; report (drawings) on every day of the course[2]
3	C	Excursion	Zoological excursions (2 half days)	0.5	1	Attendance on both excursions

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Form and systematics von Tieren	written exam practical examination	60 min 20 min	end of summer semster[3]	⅔ written exam ⅓ practical examination

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] With less than 80% of the reports (more than two absent days) access to the written exam is not allowed.

[3] A second written exam is offered in the subsequent semester break as a retake.

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Module BIO-BSc-06

1. Module title	**Plant and Animal Physiology**
2. Person responsible	Prof. Dr. Klaus Grasser, PD Dr. Oliver Bosch
3. Module contents	**Plant physiology** Basics of molecular, cellular and physiological metabolics, developmental biology and movements in plants. - principles of gene regulation - plant biotechnology - physiology of movements - physiology of metabolics - physiology of developmental biology **Animal physiology** Basics about physiology of organs and muscles and sensory physiology in animals, as well as their interaction with animals and/or humans.
4. Qualification objectives of the module / competencies to be acquired	**Plant physiology** After successful completion, students are able to - explain the molecular basics of gene expression, - outline the principles and implementation of plant biotechnology, - illustrate the process of movement and its regulation, - derive the control of metabolic reactions in plants (e.g. photosynthesis, nutrient assimilation) and its relationship with transport processes, - explain growth and development, and its regulation by light and phytohormones. **Animal physiology** After successful completion, students are able to - outline the physiology of respiration - outline the physiology of the cardiovascular system, - outline the physiology of digestion and the organs of excretion, - outline the basics of neuroendocrinology and neurophysiology, - outline the physiology of the sensory organs, - outline the physiology of the musculature, - combine the knowledge gained about physiology into an overall context, - and apply the knowledge gained about physiology.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	3rd semester

10. Workload/ Credit Points	Total hours: 211 comprising: 1. Attendance: 66 hours 2. Independent study including exam preparation: 145 hours Credit Points: 8

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Plant physiology	3	4	
2	C	Lecture	Animal physiology	3	4	

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Plant physiology	written exam	60 min	middle of winter semester[2]	50%
Animal physiology	written exam	120 min	end of summer semester[3]	50%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the second half of the semester as a retake.

[3] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-07

1. Module title	**Neurobiology, Ethology and Developmental Biology**
2. Person responsible	Prof. Dr. Inga Neumann
3. Module contents	**Lecture in Neurobiology and Ethology** - functional anatomy of vessels supplying the brain, cerebral membranes, ventricles, blood-cerebral barrier - functional anatomy of the brain regions, focus on spinal cord, limbic system, basal ganglia, cortex, hypothalamus - structure and function of neurons of the mammalian brain - receptors, enzymes and neurotransmitter systems in mammals - neurobiological behavioral tests about emotionality and social behavior in laboratory rodents - neuropeptides as neuromodulators of the brain and its functions in complex behaviors - models for psychopathological behavior - the most important neuro pharmaceuticals and their mode of action, as well as selected street drugs and their mode of action - classic and modern methods of ethology, as well as insights in the areas of habitat selection, food supply, territory defense, finding a partner, reproduction, rearing of offspring **Lecture in Developmental Biology** - model organisms of developmental biology - embryonic development in plant, animals and humans - meaning and function of stem cells and meristems - cell polarity, cell communication, and pattern formation - post embryonic development of organs in plant - genetic control of body plans, emergence of body axes, - meaning of homeotic genes in plants and animals - formation and function of gametes, - processes of fertilization in plants and animals - comparison of the essential developmental processes of different animal groups - implementation of developmental biology methods in medicine
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able **in the field of Neurobiology and Ethology** - to explain the vessels supplying the brain, cerebral membranes, ventricles, blood-cerebral barrier, - to allocate functions to regions of the brain, - to outline the physiological performance of neurons, - to designate cell types and their function in the brain, - to explain the most important neurotransmitters, receptors and enzymes, and their functions,

	- to outline experimental stages of the clarification of the functions of neurotransmitters and neuromodulators, - to outline the mode of function and targets of the most important psychotropic drugs and some street drugs, - to understand the classic and modern methods of ethology, - to formulate questions in ethology, - to explain the basics of animal behavior and be able to integrate it in the overall context. , **in the field of Developmental Biology** - to outline, specify and distinguish embryonic stages, germ lines and the process of fertilization - to explain developmental genetic screens of mutants, - to understand classic and modern methods of developmental biology, - to illustrate stem cell niches, - to recognize evolutionary relationships of developmental biology, - to understand the implementation of stem cells in research and therapy, - conduct ethical assessments and the implementation of developmental biology methods in medicine.
5. Prerequisites for Participation	
a) recommended knowledge	Module BIO-BSc-06, No. 6.2
b) mandatory courses	Modules BIO-BSc-01 and BIO-BSc-02
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	4th semester
10. Workload/ Credit Points	Total hours: 160 comprising: 1. Attendance: 45 hours 2. Independent study including exam preparation: 115 hours Credit Points: 6
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Neurobiology and Ethology	2	3	
2	C	Lecture	Developmental Biology	2	3	

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Neurobiology and Ethology	written exam	120 min	end of winter semester	50%
Developmental Biology	written exam	60 min	end of winter semester	50%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

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Module BIO-BSc-08

1. Module title	**Genetics**
2. Person responsible	Prof. Dr. Wolfgang Seufert
3. Module contents	**Lecture** - structure and dynamics of genetic material: structure of DNA and chromatin, replication, mutation, DNA repair, transposons, variation of chromosomes, - gene expression, transcription, RNA-processing, translation, genetic code, regulation of gene expression in prokaryotes and eukaryotes including epigenetics and RNA-Silencing - implementation of genetic techniques: recombinant DNA-technology, transgenetic organisms, cloning - cell cycle: mitosis, meiosis - classical genetics: mono and dihybrid inheritance according to Mendel, sex-linked heredity, pedigree analysis, coupling and mapping of genes, multiple alleles and dominance affiliation - genetic interaction: epistasis, complementation, suppression - cytoplasmatic inheritance **Exercise class** Consolidation of the contents of the lecture, with the aid of questions relevant for the examination
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - describe the structure, dynamics and expression and transfer of genetic material - explain inheritance pattern including their molecular and cellular basis.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Modules BIO-BSc-01 and BIO-BSc-02
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	4th semester
10. Workload/ Credit Points	Total hours: 135 comprising: 1. Attendance: 45 hours 2. Independent study including exam preparation: 90 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Genetics	3	4	
2	C	Exercise	Genetics	1	1	

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Genetics	written exam	90 min	end of summer semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-09

1. Module title	**Microbiology**
2. Person responsible	Prof. Dr. Dina Grohmann
3. Module contents	**Lecture** Basics - of microbial cell structure (eg. components of a bacterial cell, cell membrane, cilia, flagella, genome organization, spores etc.) - of microbial metabolism and of developmental physiology - of the molecular biology of prokaryotic cells - of genome regulation by taking the example of the phage λ - systematics of bacteria **Exercise class** - practical aspects of microbiology (e.g. light microscopy, electron microscopy) - revision of the lecture material with the aid of questions relevant for the examination
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - sketch and specify the structure and components of eukaryotic cells (with emphasis on the difference between cells from bacteria and archaea), - specify and explain the functions of prokaryotic cell components, - derive commonalities and differences between prokaryotic cells and eukaryotic systems, - recite the basic metabolic processes of bacterial cells and their characteristics, - describe the molecular processes within a prokaryotic cell (eg. transcription, translation, regulation of metabolism), - specify the methods and the current status of the taxonomy and systematic of bacteria.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Modules BIO-BSc-01 and BIO-BSc-02
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	4th semester
10. Workload/ Credit Points	Total hours: 135 comprising: 1. Attendance: 45 hours 2. Independent study including exam preparation: 90 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	
11. Module components	

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Microbiology	3	4	
2	C	Exercise	Microbiology	1	1	

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Microbiology	written exam	90 min	end of summer semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

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Module BIO-BSc-10

1. Module title	**Biochemistry**
2. Person responsible	Prof. Dr. Reinhard Sterner
3. Module contents	**Biochemistry A** - structure and traits of amino acids - structure, function and purification of proteins - enzyme kinetics, and selected catalytic mechanisms - basic principles of metabolism (anabolism, catabolism, ATC, basics of thermodynamics) - reduction of carbohydrates and fat for energy production (glycolysis, Lipolysis, β-oxidation) - biosynthesis of fatty acids and lipids - citric acid cycle - respiratory chain and oxidative phosphorylation - gluconeogenesis and Cori cycle - protein degradation - amino acid metabolism (transamination, urea cycle) - glycogen metabolism - biochemistry of membranes (membrane structure, mechanism of membrane trafficking, ion channels, membrane and action potential, ligand-gated ion channels) - hormonal regulation of metabolism (G-protein coupled receptors, nuclear receptor, kinase coupled receptors, glucagon und insulin) **Biochemistry B** - nucleotides and nucleic acids - structure of nucleic acids - metabolism of nucleotides - DNA replication, repair and recombination - transcription and RNA-processing - regulation of transcription - protein biosynthesis (translation) regulation of protein biosynthesis
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to **Biochemistry A** - describe chemical traits and reactivities of the most important substance classes - describe energy generation and regulation of catabolism and their basic themes, - describe the basic principles of selected anabolic processes. **Biochemistry B** Students gained an insight into the chemistry of nucleic acids. They understand the replication, transcription and translation of genetic information as well as their regulation on a molecular basis. They gain knowledge about central immunological molecules.

5. Prerequisites for Participation	
a) recommended knowledge	Modules BIO-BSc 14 and BIO-BSc 16
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	2 semesters
9. EmCfohlene Fachsemester	3rd/4th semester
10. Workload/ Credit Points	Total hours: 274 comprising: 1. Attendance: 88 hours 2. Independent study including exam preparation: 186 hours Credit Points: 10

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Biochemistry A	4	5	
2	C	Exercise	Biochemistry A	1	1	
3	C	Lecture	Biochemistry B	3	4	

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Biochemistry A	written exam	60 min	end of winter semester[2]	50%
Biochemistry B	written exam	60 min	end of summer semester[2]	50%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-11

1. Module title	**Mathematics**
2. Person responsible	Dean of Studies for Mathematics
3. Module contents	The module conveys basic skills in mathematics, relevant for the study program and later deployment. Such as: sets and combinatorics, elementary functions, sequences and series, limits, continuity of functions, differential and integral calculation. An introduction to probability calculation and statistics is also given as preparation for graduate courses.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to use basic mathematical methods. They can identify and distinguish elementary functions. They can calculate sequences and series and describe them and their qualitative aspects. They are able to examine real functions and identify their traits. They can calculate the most common integrals. They can specify and apply the fundamentals of probability calculations and statistics. Basic mathematical problems concerning the content of the module can be analysed and solved independently.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	1st semester
10. Workload/ Credit Points	Total hours: 167 comprising: 1. Attendance: 66 hours 2. Independent study including exam preparation: 101 hours Credit Points: 6
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Lehr-form**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Mathematics for Biologists	2	3	
2	C	Exercise	Mathematics for Biologists	2	3	exercises
3	O	Exercise	Central exercises for Mathematics for Biologists	2		

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Mathematics for Biologists	written exam	60-120 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-12

1. Module title	**Physics**
2. Person responsible	Prof. Dr. Remco Sprangers
3. Module contents	- basics concepts - translational motions - forces and motions in force fields - energy and work - collisions (elastic, inelastic) - center of mass and rotational motion - oscillation and waves - fluid mechanics, hydrostatics, fluid dynamics - temperature and heat - gas theory - thermodynamic processes - kinetic theory of gases - electrostatics - electrodynamics - magnetism - electromagnetic waves - geometrical optics - wave properties of light - diffraction (slit and grating) - light microscope
4. Qualification objectives of the module / competencies to be acquired	The graduates are familiar with the basic phenomena and concepts of classical physics. They have been taught the derivations and concepts that are required in natural sciences. The students are capable of solving simple problems in mechanics, electricity and optics.
5. Prerequisites for Participation	
a) recommended knowledge	basics in Physics acquired in high school
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	1st semester
10. Workload/ Credit Points	Total hours: 133 comprising: 1. Attendance: 44 hours 2. Independent study including exam preparation: 89 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No	**C /**	**Type of**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**

.	CE	course				
1	C	Lecture	Physics for Biologists	3	4	
2	C	Exercise	Physics for Biologists	1	1	

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Physics for Biologists	written exam	60 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-13

1. Module title	**Biological Physics**
2. Person responsible	Prof. Dr. Christine Ziegler
3. Module contents	- Modern physics: Basics in quantum mechanics, basic experiments, atom models, atomic orbital model, nuclear fission, atomic fusion - mathematics in spectroscopy, Fourier-Transformation, physical principles - methods of spectroscopy: absorption and spectrometer, UV/VIS/NIR, IR and Raman, fluorescence, CD, mass spectroscopy - 3D structural clarification: electron microscopy, X-ray analysis of crystals, NMR spectroscopy - Microcalorimetry: DSC, ITC - the lecture "introduction in to the practical course in physics" deepens the theoretical basics of the experiments.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to understand issues and methods in physics which are relevant to biology. In addition, the basics of spectroscopic and dynamic methods are covered.
5. Prerequisites for Participation	
a) recommended knowledge	basics in Physics acquired in high school
b) mandatory courses	for No. 13.3: Module BIO-BSc-12 and No. 13.1 from this Module (BIO-BSc-13)
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	2 semesters
9. Recommended semester	2. und 3rd semester
10. Workload/ Credit Points	Total hours: 149 comprising: 1. Attendance: 55 hours 2. Independent study including exam preparation: 94 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components							
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Sem.**	**Study achievement**
1	C	Lecture	Biological Physics	2	3	2. (SS)	
2	C	Lecture	Biological Physics – Introduction into the Practical course	1	1	3. (WS)	
3	C	Practical course	Biological Physics	2	1	3. (WS)	Attendance; Report for every day of the course

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Biological Physics	written exam	60 min	end of summer semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-14

1. Module title	**General Chemistry**
2. Person responsible	Dean of Studies for Chemistry
3. Module contents	Atom theory, empirical gas laws and kinetic gas theory, microscopic structure of matter: elementary particles, atoms, wave-particle duality and the quantum theory description of electrons in atoms, discussion of the results of simple single particle systems, single and multiple electron atoms, the principles of the structure of the periodic table of elements, radioactive decay. Basics of stoichiometry, chemical equilibrium and mass action law, process and product of solution. Acids and bases: definition and quantitative handling of acid-base-equilibria and buffer systems, electrochemical potential, electrochemical series, redox and complex equilibria. The chemical bond: ion compounds, metals, the covalent bond, electro negativity, polarity and dipole moment, description of simple molecules with the MO-theory, spatial structure of molecules, week binding force.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to distinguish empirical descriptions and theoretical approaches in science. The student understands the necessity of quantum mechanics to describe the atomic structure of matter, and is able to apply its results to the description of chemical bonding. He or she understands the coherence between the structure of electrons and the special structure of chemical bonds. Additionally, he or she is able to apply stoichiometric calculations in the context of reaction process and equilibrium processes in chemical solutions.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	1st semester
10. Workload/ Credit Points	Total hours: 134 comprising: 1. Attendance: 44 hours 2. Independent study including exam preparation: 90 hours Credit Points: 5
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No	**C /**	**Type of**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**

.	CE	course				
1	C	Lecture	General Chemistry for Biologists	2	3	
2	C	Exercise	General Chemistry for Biologists	2	2	

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
General Chemistry for Biologists	written exam	120 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-15

1. Module title	**Inorganic Chemistry**
2. Person responsible	Dean of Studies for Chemistry
3. Module contents	**Quantitative part** Quantitative determinations of familiar ions in aqueous solution are conducted. Different wet chemical analytical methods are deployed, like titration (e.g. acid-base and redox titrations) and determinations using simple instruments and tools. Additionally, the adjustment of substance concentration is conducted as per specification (e.g. buffer system). This way, the principles of reactions in aqueous solution e.g. dissociation equlibrium, pH-value, complex formation constants and solubility products are imparted through practical examples. **Qualitative part** By using simple chemical experiments and qualitative-chemical analysis, knowledge of chemical substances are conveyed, and the manner of reaction of selected cations and anions and their safe handling is learned. The theoretical approach and experimental handling of important chemical basics, e.g. solubility und solubility products (metathesis reaction, precipitation reaction), ph-value (dependencies, buffer systems), dissociation equilibria, complex formation constants, reduction and oxidation reactions, are learned in simple manual tests and then applied in chemical separation.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to formulate basic chemical equations and identify the relationships of chemical equilibrium and chemical reactions in process. They are able to apply common theoretical relationships in the context of practical problems. They are able to assemble basic glass equipment and conduct basic chemical reactions by the book. In addition, they can distinguish common laboratory chemicals regarding their main characteristics and are able to appraise their reactivity.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Module BIO-BSc-14
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	2nd semester

10. Workload/ Credit Points	Total hours: 139 comprising: 1. Attendance: 66 hours 2. Independent study including exam preparation: 73 hours Credit Points: 5

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Practical course	Inorganic Chemistry	4	3	colloquia and reports on every day of the course
2	C	Seminar	Inorganic Chemistry	2	2	

12. Module examination

Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Anorganic Chemistry	written exam	120 min	end of summer semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-16

1. Module title	**Organic Chemistry I**
2. Person responsible	Dean of Studies for Chemistry
3. Module contents	- principles of organic chemistry: nomenclature, structure and bonding, functional groups, stereoisomerism, delocalization, mesomerism, catalysis - coherence within organic substance classes, characteristic functional groups and their reactivity: alkanes / radical substitution, alkenes / electrophile addition, halogenous alkanes / electrophile substitution, carbonyl compounds / nucleophile acyl substitution and addition, oxidation / reduction - introduction to bioorganic chemistry: carbohydrates, proteins / enzymes / co enzymes, nucleic acids
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students know the organic substance groups and their specific traits, their respective functional groups and their fundamental mechanisms of reactions and influence parameters, the principles of the stereoisomerism and stereo selectivity, and the most important bioorganic substance groups and their meaning in chemical biology. The students are able to use the acquired exemplary knowledge, in order to classify organic compounds they do not know. On the basis of their structure, students can make sensible suggestions about the traits and reactivity of these compounds. For the synthesis of simple organic compounds students can suggest and evaluate different routes.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	2nd semester
10. Workload/ Credit Points	Total hours: 180 comprising: 1. Attendance: 75 h 2. Independent study including exam preparation: 105 h Credit Points: 6
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components						
No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Organic Chemistry I	4	5	
2	C	Seminar	Organic Chemistry I	1	1	

12. Module examination				
Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Organic Chemistry I	written exam	120 min	end of summer semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-17

1. Module title	**Organic Chemistry II**
2. Person responsible	Dean of Studies for Chemistry
3. Module contents	**Lecture und Seminar** - consolidation and broadening knowledge of organic reaction mechanisms - new reaction mechanisms: rearrangement, cyclic addition - the theory of reactions important for preparations - principles of region and stereo selective syntheses - design of basic multistage syntheses **Practical course** - synthesis of organic molecules of lower to medium complexity - systematic learning of basic laboratory methods and working techniques, such as sublimation, distillation, extraction or chromatography - designing experiments by the book - safe handling and accurate disposal of hazardous substances - analytical monitoring of the progress of reactions using common techniques and characterizing the products of reactions with standard analytical techniques, like the determination of the melting point and the refraction index, IR and NMR spectroscopy - recording the procedure and results of experiments
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to identify mechanisms of reactions in organic chemistry. Students can use the acquired exemplary knowledge, to classify the reactions in organic chemistry they know. On the basis of the structure of compounds, students can make sensible suggestions about the traits of these compounds, about their reactivity, and their targeted conversion into new compounds. For the synthesis of simple organic compounds students can suggest and evaluate different and also multistep routes. After completion of the module, students are able to independently plan and safely conduct organic synthesis given professional instruction, even over multiple steps. In addition to this, they master and apply basic laboratory and working techniques, as well as the handling and safe disposable of hazardous substances. Students can analyze products of reactions with standard procedures.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	For No. 3 of the Module: Module BIO-BSc-16
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	3rd semester
10. Workload/ Credit Points	Total hours: 270 h

	comprising: 1. Attendance: 150 h 2. Independent study including exam preparation: 120 h Credit Points: 9

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Organic Chemistry II	3	4	
2	C	Seminar	Organic Chemistry II	2	2	
3	C	Practical course	Organic Chemistry	5	3	Report to every experiment

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Organic Chemistry II	written exam	120 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-18

1. Module title	**Physical Chemistry**
2. Person responsible	Dean of Studies for Chemistry
3. Module contents	Physical chemistry deals with concepts which lead to a better understanding of the macroscopic traits the matter. Thermodynamics: Properties of ideal and real gases, principles of the state function (total differential), heat and work, fundamental theorems of thermodynamic, analysis of the energetic ratios of processes (internal energy and enthalpy), spontaneity of processes (circular processes, thermal engine, entropy), states of equilibrium (chemical potential), phase equilibrium of pure substances (melting, vaporization) colligative traits of mixtures (lowering of the freezing point, osmotic pressure, Raoult's and Henry's laws, equilibrium of chemical reactions and the mass action law. Interfacial chemistry: surface tension, capillary pressure, wetting angle, the process of adsorption, the building of mono molecular layers. Electrochemistry: galvanic and electrolytic cells, electro chemical electromotive series, Nernst equation, Faradayic laws, corrosion, fuel cells. Kinetics: differential and integral time laws for simple and composite reactions, temperature-dependence of the reaction rate (Arrhenius equation), and activating energy. In the exercises accompanying the lecture, the knowledge acquired is applied to solve particular tasks in physical chemistry.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to convey the concepts of the chemical thermodynamics, electrochemistry and interfacial chemistry, as well as the kinetic of chemical reactions and apply them. Students can explain different every day phenomenon by means of physico-chemical values and cancalculate them. The module should convey the scientific mode of thinking of physical chemistry to students and contribute to recognizing and solving problems relevant to the field.
5. Prerequisites for Participation	
a) recommended knowledge	Modules BIO-BSc-11 until BIO-BSc-14
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	3rd semester

10. Workload/ Credit Points	Total hours: 140 comprising: 1. Attendance: 66 hours 2. Independent study including exam preparation: 74 hours Credit Points: 5

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[1]**	**Study achievement**
1	C	Lecture	Physical Chemistry	2	3	
2	C	Exercise	Physical Chemistry	1	1	
3	C	Tutorial	Physical Chemistry	3	1	

12. Module examination

Competence / subject area	**Type of examination**	**Duration**	**Time of examination**	**Percentage of module grade**
Physical Chemistry	written exam	120 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-19

1. Module title	Practical Module
2. Person responsible	Dean of Studies for Biology
3. Module contents	**Practical course in Plant Physiology** - analysis of some physiological relevant mechanisms, such as the effect of phytohormones and light, and photosynthesis - some biochemical working procedures, such as chromatography and electrophoresis **Practical course in Animal Physiology** Consolidation of theoretical knowledge from the lecture Animal Physiology using descriptive experiments (sensory physiology, cardiac activity, blood pressure, neuro endocrinology) **Practical course in Genetics** Experiments on mutation analysis, complementation, genetic linkage, gene deletion due to recombination, protein expression and DNA fingerprint analysis. Methods: transformation of *E. coli* and *S. cerevisiae*, preparation of DNA, restriction digest, CPR, agarose gel electrophoresis, SDS-CAGE, microscopy **Practical course in Microbiology** - basics of microbial work techniques - sterile working - preparing solutions - colouring - using a light microscope - experiments for isolation and characterizing microorganism and environmental samples - simple physiological tests - identifying bacterial growth - the effect of antibiotics and bacteriophages **Practical course in Evolutionary Biology und molecular Ecology** Introduction into ways of working, questions and methods of modern organismic biology on the basis of current scientific examples. Topics of the experiments: - determination of the structure of plant populations and insect states - analysis of ecological processes using molecular methods - interaction between animals and plant - reconstruction of a phylogenetic tree - chemical communication Methods: - polymerase chain - gene sequencing

	- "bar-coding" - gas chromatography - mass spectrometry **Practical course in Physical Chemistry** Consolidation of the theoretical background from the lecture "Physical Chemistry" by supervised experimental work. The focus is on the study of the functional principles of the instruments and methods used, the assessment of specific hazardous potentials of the experiments and the application of the principles of good scientific practice when analyzing data (experimental report). The practical course comprises eight experiments: - identifying the heat of combustion of biological basic elements as well as the heat of solution of salts, identifying the molar mass of compounds by analyzing the freezing point depression of solutions, - analyzing interface phenomenon and monomolecular layers, - using optical methods to determine concentrations, - elucidatiny structure with dynamic light scattering, - analyzing galvanic cells and fuel cells, - investigating the conductivity of electrolyte solutions as important analytical methods, - studying of biological relevant buffer systems with the glass electrode.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to **in the practical course Plant Physiology** - experimentally demonstrate photosynthetic activity and the effect of phytohormones, - examine transport processes in plants, - use important biochemical separation methods (electrophoresis, chromatography) - characterize biochemical traits of enzymes, - prepare solutions and reaction mixtures, - prepare biochemical extracts, and handle pipettes and other laboratory instruments, - evaluate and interpret ones own experimental results. **in the practical course Animal Physiology** - conduct physiological experiments comparing the vision of insects and humans, - conduct physiological experiments about the cardiovascular system in humans, - conduct physiological experiments about the heart activity in vertebrates, - conduct physiological experiments about neuroendocrinology in vertebrates, - statistically assess and discuss experimental results. **in the practical course Genetics** use basic techniques in molecular genetics.

	in the practical course Microbiology - prepare sterile growth media, as well as transfer and purify bacterial cultures in a sterile way, - conduct and assess simple classifications of bacteria with the aid of physiological tests using scientific criteria, - independently produce bacterial culture for phase contrast microscopy as well as differential coloring and assess them with light microscopy. **in the practical course Evolutionary Biology and Molecular Ecology** - assign appropriate research methods to different scientific questions of molecular ecology and evolutionary biology, - conduct CPR and microsatellite genotyping, - conduct basic population genetic and phylogenetic / phylogeographic analysis with the appropriate statistic programs, - understand how complex mixtures of fragrances can be analyzed with GC/MS, - identify species with molecular methods. **in the practical course Physical Chemistry** - use different physical-chemical measurement methods and critically analyze the experimental data gained, - asses the data they gather by using the theoretical methods learned and calculate answers to specific questions.
5. Prerequisites for Participation	
a) recommended knowledge	**For the part of the module:** No. 6: Modules BIO-BSc 11, BIO-BSc 14, BIO-BSc 18
b) mandatory courses	**For the part of the module respectively:** No. 1: No. 6.1 from the Module BIO-BSc-06 No. 2: No. 6.2 from the Module BIO-BSc-06 No. 3: Module BIO-BSc-08 No. 4: Module BIO-BSc-09 No. 5: Modules BIO-BSc-01 until 05
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter / summer semester, every year
8. Module can be completed in	2 semesters
9. Recommended semester	3rd / 4th / 5th semester
10. Workload/ Credit Points	Total hours: 238 comprising: 1. Attendance: 132 hours 2. Independent study including exam preparation: 106 hours Credit Points: 9

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the

module components (No. 11) and the module examination (No. 12).

11. Module components[1]

No.	C / CE	Type of course	Subject area	CHS	CP[2]	Study achievement
1	CE	Practical course	Plant Physiology/Biochemistry	4	3	Attendance; reports of each course day
2	CE	Practical course	Animal Physiology	4	3	Attendance; reports of each course day
3	CE	Practical course	Genetics	4	3	Attendance; written exam
4	CE	Practical course	Microbiology	4	3	Attendance; written exam
5	CE	Practical course	Evolutionary Biology und molecular Ecology	4	3	Attendance; reports of each course day
6	CE	Practical course	Physical Chemistry	4	3	Attendance; reports of each course day

12. Module examination

The module is not graded.

13. Notes

[1] At least three practical courses have to be chosen; including at least one practical course from No. 1 and No. 2, as well as at least one practical course from No. 3 and No. 4.

[2] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-21

1. Module title	Key Qualification
2. Person responsible	Dean of Studies for Biology
3. Module contents	**Seminars** - scientific presentation in the field of biology **Experimental design** - scientific approach - different experimental designs and their advantages and disadvantages - potentials and limits of statistical results and statements - scientific rules of experimental design and evaluation **Digital Image Processing** - what is a digital image and how does it develop? - what information do digital images contain? - editing of digital images with open source programs. - legal and illegal processing steps for scientific data. - quantification of contents of images. - preparing illustrations for an academic text (e.g. bachelor´s thesis) **Scientific Writing** - features and formats of scientific publications - scientific Illustrations and legends - stylistic options - practical approach for the writing of a scientific report
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to **in seminars** - structure the contents from scientific literature texts and convey the contents via an oral presentation, - independently investigate and assess different sources on specific scientific topics, - assess and discuss the contents of oral presentations from other students. **in experimental design** - understand and develop different basic experimental designs on the basis of scientific approaches (which means based on hypothesis) - consider ethical principles when designing and evaluating an experiment according to good scientific practice. **in digital image processing** - analyze and quantify digital data of images from different sources, - compose illustrations for scientific publications from raw digital data, - critically conduct image analysis and image processing with scientific criteria, - apply good scientific practice with image processing and image presentation. **in scientific writing** - understand the structure if information in scientific reports

5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter / summer semester, every year
8. Module can be completed in	2 semesters
9. Recommended semester	4th / 5th / 6th semesters
10. Workload/ Credit Points	Total hours: 271 comprising: 1. Attendance: 148 hours 2. Independent study including exam preparation: 123 hours Credit Points: 10

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	**C / CE**	**Type of course**	**Subject area**	**CHS**	**CP[3]**	**Study achievement**
1	C	Seminar	Seminar in Biology I [1]	2	2	oral presentation
2	C	Seminar	Seminar in Biology II [1]	2	2	oral presentation
3	C		Job Skills[2]	3	3	attendance
4	C	Lecture	Design and Analysis: experimental design, digital image processing, scientific writing	2	3	portfolio

12. Module examination The module is not graded.

13. Notes

[1] Students can choose from a selection of seminars offered by the faculty.

[2] Students can choose from a selection of job skills. Among other job qualifying courses, for up to two career days and/or fairs, attendance can be credited with career days and fairs1 CP each.[3] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-22

1. Module title	**Statistics and Bioinformatics**
2. Person responsible	Prof. Dr. Florian Hartig
3. Module contents	**Statistics** - probability theory - descriptive statistics - estimation of unknown parameters - confidence intervals - formulating and testing hypotheses - selected statistical tests (t-tests, Chi-Square-test, ANOVA) - correlation and regression - non-parametric tests - multivariate statistics **Bioinformatics** - test theory - Bayesian method - theory and application of pairwise comparisons of sequences - composing and analyzing multiple sequence alignments - use Markow chains and hidden Markow models - phylogenetic procedures
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to **in Statistics** - include statistical competences for experimental design - display and analyze data collected in an appropriate form - examine hypotheses with adequate statistical tests **in Bioinformatics** - use sequence comparison methods for problems in biology - estimate the relevance of results.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	5th Semester

10. Workload/ Credit Points	Total hours: 179 comprising: 1. Attendance: 55 hours 2. Independent study including exam preparation: 124 hours Credit Points: 6

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[1]	Study achievement
1	C	Lecture	Statistics and Bioinformatics	4	5	
2	C	Exercise	Exercise to the Lecture Statistics and Bioinformatics	1	1	exercises

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Statistics and Bioinformatics	written exam	120 min	end of winter semester[2]	100%

13. Notes

[1] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

[2] A second written exam is offered in the subsequent semester break as a retake.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-23

1. Module title	**Specialization Module – Lectures**
2. Person responsible	Dean of Studies for Biology
3. Module contents	Deepening knowledge in specific topics of biology.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to analyze new scientific projects and scientific controversies within a specific topic.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter and summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	5th / 6th semester
10. Workload/ Credit Points	Total hours: 238 comprising: 1. Attendance: 66 hours 2. Independent study including exam preparation: 172 hours Credit Points: 9

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[2]	Study achievement
1	C	Lecture	Special Lecture in Biology I[1]	2	3	written or oral examination
2	C	Lecture	Special Lecture in Biology II[1]	2	3	written or oral examination
3	C	Lecture	Special Lecture in Biology or non-Biology III[1]	2	3	written or oral examination

12. Module examination

The module is not graded.

13. Notes

[1] Students can choose from a selection of lectures offered within the faculty and from non-Biology lectures within the university.

[2] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-B.Sc.-24

1. Module title	**Specialization Module – Practical courses**
2. Person responsible	Dean of Studies for Biology
3. Module contents	- Deepening the knowledge in specific topics of biology. - Deepening practical skills in the laboratory.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to work independently and scientific oriented.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	Modules BIO-BSc-01 until 05, BIO-BSc-11, BIO-BSc-12 and BIO-BSc-14 until 16
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter and summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	5th / 6th semester
10. Workload/ Credit Points	Total hours: 325 comprising: 1. Attendance: 210 hours 2. Independent study including exam preparation: 115 hours Credit Points: 12
Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).	

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP[2]	Study achievement
1	C	Practical course	Practical Course I[1]	9	6	protocol and/or oral presentation
2	C	Practical course	Practical course II[1]	9	6	protocol and/or oral presentation

12. Module examination

The module is not graded.

13. Notes

[1] Students can choose from a selection of practical courses offered by the faculty.

[2] The information on CPs only serves to calculate the workload of each of the module's courses. The CPs are awarded only after successful completion of the module.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-25

1. Module title	**Research Module**
2. Person responsible	Dean of Studies for Biology
3. Module contents	- Further knowledge of specific topics of biology. - Further practical skills in the laboratory. - Presentation of a scientific topic within biology.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - work independently and scientifically, - structure the contents of texts from the scientific literature and convey the contents via an oral presentation, - independently investigate and assess different sources about specific scientific topics, - assess and discuss the contents of oral presentations delivered by other students.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	at least 132 CP, including following modules: - BIO-BSc-01 until 06, - at least three modules from BIO-BSc-07 until 10, - BIO-BSc-11 until 18, - BIO-BSc-24
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter and summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	6th Semester
10. Workload/ Credit Points	Total hours: 320 comprising: 1. Attendance: 232 hours 2. Independent study including exam preparation: 88 hours Credit Points: 12

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP	Study achievement
1	C	Practical course	Scientific Practical Course [1] (6 weeks) with seminar The practical course will be done in one of the faculty's laboratorys in preparation for the bachelor´s thesis.	19	12	protocol and/or oral presentation

12. Module examination

The module is not graded.

13. Notes

[1] Students can choose from a selection of scientific practical courses offered by the faculty.

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class

Module BIO-BSc-26

1. Module title	**Bachelor´s Thesis**
2. Person responsible	Dean of Studies for Biology
3. Module contents	- Further knowledge in specific topics of biology. - Further practical skills in the laboratory. - Presentation of a scientific topic within biology.
4. Qualification objectives of the module / competencies to be acquired	After successful completion, students are able to - work independently and scientifically, - structure the contents of texts from the scientific literature and convey the contents via an oral presentation, - - independently investigate and assess different sources about specific scientific topics, - assess and discuss the contents of oral presentations delivered by other students.
5. Prerequisites for Participation	
a) recommended knowledge	
b) mandatory courses	at least 132 CP, including following modules: - BIO-B.Sc.-01 until 06, - at least three modules from BIO-B.Sc.-07 until 10, - BIO-B.Sc.-11 until 18, - BIO-B.Sc.-24
6. Module can be used for	B.Sc. Biology
7. Module is offered	winter and summer semester, every year
8. Module can be completed in	1 semester
9. Recommended semester	6. Semester
10. Workload/ Credit Points	Total hours: 350 comprising: 1. Attendance: 245 hours 2. Independent study including exam preparation: 105 hours Credit Points: 12

Prerequisite for the achievement of the credit points (No. 10) is the successful completion of all the module components (No. 11) and the module examination (No. 12).

11. Module components

No.	C / CE	Type of course	Subject area	CHS	CP	Study achievement
1	C		Bachelor´s Thesis (10 weeks)	19	12	oral presentation

12. Module examination

Competence / subject area	Type of examination	Duration	Time of examination	Percentage of module grade
Bachelor´s Thesis	Bachelor´s Thesis			100 %

13. Notes

Legend: C = Compulsory; CE = Constrained elective ; CHs = Credit hours (1 CH = 45 min/ per week in a semester); CP = Credit point (1 CP = 25-30 h workload) ; L = Lecture ; E = Exercise class