Description of Module Master of Science 926 Microbiology

PO-Version 2018

FRIEDRICH-SCHILLER-UNIVERSITÄT JENA

Contents summary

Note : Please note that you can find the information on examinations, courses corresponding to the examinations, and examination dates in the portal Friedolin under the menu item ‘Browse module descriptions’. After logging in, please choose your degree, your study programme, and respective module. Any immediate changes made will be displayed promptly.

Erläuterung zum Modulkatalog

Modul **MMB001** Introduction to Microbiology	
Module code	MMB001
Module title (German)	Einführung in die Mikrobiologie
Module title (English)	Introduction to Microbiology
Person responsible for the module	Krause
Prerequisites for admission to the module	none
Prerequisite for what other modules	Required elective modules, Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Compulsory module: Basic module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in winter semester)
Duration of module	2 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	E exercise to microbiology, block in the first week of lecture (2 hpw) S Microbial Communication Colloquium, during 2 semesters bi-weekly (2 hpw) S Scientific Methods (1 hpw)
ECTS credits	6 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	180 h 75 h 105 h
Content	Organized by 3rd semester students, the exercise introduces techniques in microbiology to level different entrance levels among the study course. The seminar will introduce the subjects of BSc theses of the participants to show the width of microbiology. In self-study phylogeny, physiology and molecular biology are studied for the three domains of live. The "Microbial Communication Colloquium" introduces modern scientific subjects and methods in microbiology.
Intended learning outcomes	Basic methods in microbiology like media preparation, plating, pipetting (E) are trained and an overview on current subjects in microbiology (S) are studied. Regular participation in the practical exercise, the seminar and the colloquium is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar contribution (passed)
Requirements for awarding credit points (type of examination)	Oral examination on basic microbiology at the end of the 2nd semester (100 %)

Modul **MMB002** Microbial Physiology	
Module code	MMB002
Module title (German)	Physiologie von Mikroorganismen
Module title (English)	Microbial Physiology
Person responsible for the module	N. N. (per pro, Kothe)
Prerequisites for admission to the module	none
Prerequisite for what other modules	Required elective modules, Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Compulsory module: Basic module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in winter semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course, block 4 weeks half-day (5 hpw); V 2 hpw
ECTS credits	8 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	240 h 105 h 135 h
Content	The lecture contains selected energy metabolism pathways in bacteria and archaea with specific impact of ecological impacts. In the course, the fermentation metabolism is characterized including chemical and physical analytic techniques. The results of the course are summarized in a protocol.
Intended learning outcomes	An overview on selected energy metabolic pathways and element cycles (L), growth and cell fractioning, analytical and molecular biology methods, characterization of proteins and mutants (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk in the practical course (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB003** Microbial Communication	
Module code	MMB003
Module title (German)	Mikrobielle Kommunikation
Module title (English)	Microbial Communication
Person responsible for the module	Kothe
Prerequisites for admission to the module	none
Prerequisite for what other modules	Required elective modules, Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Compulsory module: Basic module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in winter semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course, block 4 weeks half-day (5 hpw); V 2 hpw
ECTS credits	8 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	240 h 105 h 135 h
Content	Basic microbiology and molecular biology techniques (including -omics technologies) are introduced and investigation of secondary metabolites is shown. Specific impact is on strategies for interactions with the environment, between microorganisms and of microbes with their plant host (P). Examples include secondary metabolite production or molecular mechanisms in bacteria and fungi (L).
Intended learning outcomes	Knowledge and skills in microbiology (P); presentation of results in the form of publications as basis for the Master thesis; knowledge in molecular interactions (L). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk in the practical course (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB004** Microbial Interactions	
Module code	MMB004
Module title (German)	Mikrobielle Interaktionen
Module title (English)	Microbial Interactions
Person responsible for the module	N. N. (per pro, Kothe)
Prerequisites for admission to the module	none
Prerequisite for what other modules	Required elective modules, Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Compulsory module: Basic module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in winter semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course, block 4 weeks half-day (5 hpw); V 2 hpw
ECTS credits	8 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	240 h 105 h 135 h
Content	Methods in microbiology and molecular biology for the analysis of microbial communities and microbiomes as well as the analysis of interactions are given (P). Examples for symbiotic, parasitic and commensal interactions are introduced (L).
Intended learning outcomes	Knowledge and skills in microbiology (P); presentation of results in the form of an extended protocol; knowledge in molecular interactions (L). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk in the practical course (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB005** Microbiology and Molecular Biology	
Module code	MMB005
Module title (German)	Mikrobiologie und Molekularbiologie
Module title (English)	Microbiology and Molecular Biology
Person responsible for the module	Brakhage
Prerequisites for admission to the module	none
Recommended or expected prior knowledge	
Prerequisite for what other modules	Required elective modules, Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Compulsory module: Basic module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in winter semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course 5 hpw, blocked; L 2 hpw
ECTS credits	8 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	240 h 105 h 135 h
Content	The module contains basic methods in molecular biology and microbiology. A focus is on production of geneticall modufied fungi and bacteria (P). Different transformation strategies are presented and mutants characterized on a molecular level. The capacity of microorganisms to form secondary metaboites is presented (L).
Intended learning outcomes	Knowledge and skills in molecular microbiology; presentation of scientific publications; molecular biology of microorganisms. Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk in the practical course (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB006** Adaptation in Microorganisms	
Module code	MMB006
Module title (German)	Adaptation bei Mikroorganismen
Module title (English)	Adaptation in Microorganisms
Person responsible for the module	N. N. (per pro, Kothe)
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 5 hpw, blocked, 4 weeks half-day; L 2 hpw; S 1 hpw
ECTS credits	10 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	300 h 120 h 180 h
Content	Bacteria and fungi are grown and specific adaptation are shown. Different strategies for microbial metabolism in distinct niches and the theoretical requirements for adaptation are central subjects. The practical course employs specific methods. The seminar gives insight into actual original research papers on microbiology subjects.
Intended learning outcomes	Theoretical basics (L) and methods for adaptation are learned (P), original papers and techniques (S) are presented. Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB007** Molecular Communication in Basidiomycetes	
Module code	MMB007
Module title (German)	Molekulare Kommunikation bei Basidiomyceten
Module title (English)	Molecular Communication in Basidiomycetes
Person responsible for the module	Kothe
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 5 hpw, blocked, 4 weeks half-day; L 2 hpw (alternatively as E); ; 1 hpw Excursion
ECTS credits	10 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	300 h 120 h 180 h
Content	The lecture introduces higher fungi of the group of dikarya; alternatively the subjects can be prepared in a home work (L or E). The research focussed practical course is directed at approaches, which can be used for a master´s thesis in each part of microbiology (P). Molecular mechanisms of cell biology and fundamentals of communication in fungi are treated, e. g. the phenotypic characterization of transformants which overexpress mutant proteins of intracellular signal transduction. Methods of gene identification and database analysis are trained.
Intended learning outcomes	Overview and detailed knowledge on the phylogeny and systematics/ taxonomy (L); cell biology and molecular genetics of eukary (P) and focussing on research topics (S) are trained. Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Preparation of special subjects (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB008** Microbial Consortia	
Module code	MMB008
Module title (German)	Mikrobielle Gemeinschaften
Module title (English)	Microbial Consortia
Person responsible for the module	N. N. (per pro, Kothe)
Prerequisites for admission to the module	Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 5 hpw, blocked, 4 weeks half-day; S 2 hpw; E 1 hpw
ECTS credits	10 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	300 h 120 h 180 h
Content	The interrelationships in microbial consortia are introduced and mechanisms of cross-talk introduced (L, S). Analyses using DNA-dependent and cultivation strategies are trained and microbiome analyses shown (P).
Intended learning outcomes	Praparation of complex subjects (L) with new literature (S); microbiome analyses (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Preparation of special subjects (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB009** Molecular Infection Biology of lower Eukaryotes	
Module code	MMB009
Module title (German)	Molekulare Infektionsbiologie niederer Eukaryonten
Module title (English)	Molecular Infection Biology of lower Eukaryotes
Person responsible for the module	Brakhage
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 5 hpw, blocked, 4 weeks half-day; L 2 hpw; S 1 hpw
ECTS credits	10 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	300 h 120 h 180 h
Content	Molecular biology (gene regulation, signal transduction, genomics) of eukaryotic microorganisms; biotechnology of the production of proteins, antibiotics, amino acids; combinatorial biosynthesis, secondary metabolism. Transcriptome and proteome analysis.
Intended learning outcomes	Overview and deepened knowledge of molecular biology (L), genomics and biotechnology of fungi (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Written exam to L (70 %), Protocols to P (30 %)

Modul **MMB010** Biotechnology - Bioelectrochemistry	
Module code	MMB010
Module title (German)	Biotechnologie - Bioelektrochemie
Module title (English)	Biotechnology - Bioelectrochemistry
Person responsible for the module	Rosenbaum
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course 2 hpw, blocked, 2 weeks half-day; L 2 hpw,
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Electricity generating bacteria? Microorganisms convert electric currents and carbon dioxide into chemicals? Electron transfer through isolating cell walls? After giving the basics for biotechnology and iengineering, those and other applications of bioelectrochistry are introduced. A focus is put on knowledge concerning the basic microbial processes. In a project, potential applications for bioelectochemical systems are developed by the students and practically implemented.
Intended learning outcomes	Basics in bioelectrochemistry on enzymatic and microbial processes (L), physiology of bacteria as biokatalytic actors at electrodes, technical application (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Written exam to L (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100%)

Modul **MMB011** Molecular and Microbial Infection Biology	
Module code	MMB011
Module title (German)	Molekulare und mikrobielle Infektionsbiologie
Module title (English)	Molecular and Microbial Infection Biology
Person responsible for the module	Hube
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	Practical course 2 hpw, blocked, usually 1 week full-day; L 2 hpw
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Molecular biology, microbiology and infection biology of human-pathogenic bacteria, parasites and fungi. General principles are compared in more depth discussed with examples. In the practical course, molecular biology for the investigation of human-pathogenic yeasts of the genus Candida are presented and applied with a focus on gene expression of virulence factors and host-pathogen interaction combined with mutant mutation and characterization in pathogenic fungi.
Intended learning outcomes	Overview and deepened knowledge of molecular biology / microbiology / infection biology of human pathogenic fungi (P, S). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Written exam (60%), Seminar talk, experimental work and protocols in P (40 %)

Modul **MMB012** Immune reactions of humans to Microorganisms and Pathogens	
Module code	MMB012
Module title (German)	Immunreaktion des Menschen auf Mikroorganismen und Pathogene
Module title (English)	Immune reactions of humans to Microorganisms and Pathogens
Person responsible for the module	Zipfel
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	L 2 hpw, P 2 hpw, blocked, 1 week full-day
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Immune reactions of humans against microorganisms and pathogens, immune evasion of pathogens and microorganisms, genetic susceptibility for infections, methods in immune and infection biology
Intended learning outcomes	Overview and deepened knowledge of immune biology (L), molecular biology, infection biology (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Written exam (70%), protocols or talk in P (30 %)

Modul **MMB013** Biomolecular Chemistry	
Module code	MMB013
Module title (German)	Biomolekulare Chemie
Module title (English)	Biomolecular Chemistry
Person responsible for the module	Hertweck
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	L 2 SWS, P 2 SWS, blocked, usually 1 week full-day
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Biology and chemistry of natural compounds from microorganisms, structures of natural compounds, biosyntheses, screening methods, chemical analysis and molecular biological analysis of biosynthesis genes. Knowledge of the lecture in winter semester is required (can be accepted alternatively)
Intended learning outcomes	Overview (L) and deepened knowledge (P) of the biology and chemistry of natural compounds from microorganisms. Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Oral or written exam (100 %)
Additional information on the module	It is strongly recommended that the contents of the MSc lecture Natural Compound Chemistry are well known.

Modul **MMB014** Geomicrobiology	
Module code	MMB014
Module title (German)	Geomikrobiologie
Module title (English)	Geomicrobiology
Person responsible for the module	Küsel
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	L 2 hpw (in winter semester), P 2 hpw, blocked, usually 1 week
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	The module deals with the importance of microbial processes in aquatic habitats. The lecture will give an overview about the origin of life on early Earth, the evolution of metabolic diversity and the interaction of microbes with minerals. We will also highlight the importance of recently discovered processes like anaerobic methane oxidation or annamox in marine and freshwater ecosystems. In the seminar and practical course, specific microbial processes in an aquatic habitat will be studied with biogeochemical methods in the field and molecular analyses. A lecture during winter semester provides necessary knowledge.
Intended learning outcomes	Importance of microorganisms for element cycles during 4 billions of years (P); overview of the current research (S). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Written exam (50%), protocol (50%)

Modul **MMB015** Chemical Ecology	
Module code	MMB015
Module title (German)	Chemische Ökologie
Module title (English)	Chemical Ecology
Person responsible for the module	Boland
Prerequisites for admission to the module	1 Compulsory module: basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	S 2 SWS; P 2 SWS, blocked
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Introduction into ecological and evolutionary theory of interactions, molecular mechanisms of evolution, levels of selection, individuality, and the evolution of cooperation. The evolution of sex and life-histories.
Intended learning outcomes	A basic understanding of fundamental (chemical) ecological and evolutionary principles and concepts with a particular focus on microorganisms (P). Participants will practice to introduce a complex topic (S). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Protocol to P (100%)

Modul **MMB016** Translational Medical Microbiology	
Module code	MMB016
Module title (German)	Translationale medizinische Mikrobiologie
Module title (English)	Translational Medical Microbiology
Person responsible for the module	Jacobsen
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	L 2 SWS; P 2 SWS, blocked
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	The lecture introduces medical microbiology focusing on applied aspects. Central is the work with human materials for research in infection biology.
Intended learning outcomes	Methods in translational medical microbiology, legal framework for working with pathogens and protective measures (S), detection of pathogens, analysis of pathogen-host interaction with cell biology methods, detection of antibodies and antigen specific T-cell response (P). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Prepared subject presentation in P (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB017** Microbe-Plant Interactions	
Module code	MMB017
Module title (German)	Mikroben-Pflanzen-Interaktionen
Module title (English)	Microbe-Plant Interactions
Person responsible for the module	Kothe
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 2 hpw, blocked, 2 weeks half-day, S 2 hpw
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Plant- microbe associations are introduced with fungi and bacteria of phytopathogenic, symbiotic or endophytic nature. The methods involve basics for the Master thesis in microbiology. Molecular mechanisms of cell biology and basics in communication are given. Phenotypical characterization of transformants and the basics of bioinformatic analyses including gene identification and databank as well as expression analyses are provided.
Intended learning outcomes	Understanding plant-microbe interactions in nature, Koch's postulates and preparing new subjects with original literature (P). Data analysis and presentation skills (S). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB018** Microbial Metabolism	
Module code	MMB018
Module title (German)	Mikrobielle Stoffwechselvielfalt
Module title (English)	Microbial Metabolism
Person responsible for the module	N. N. (per pro, Kothe)
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P 2 hpw, blocked, 2 weeks half-day, S or L 2 hpw
ECTS credits	5 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150 h 60 h 90 h
Content	Aerobic and anaerobic metabolism, bacteria and fungi, specific strategies for evolutionary adaptation and host interactions
Intended learning outcomes	A protocol is prepared scientifically discussed (P) and new literature selected and presented (S). Regular participation in the practical course is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	Seminar talk in P (passed)
Requirements for awarding credit points (type of examination)	Protocol to the practical course (100 %)

Modul **MMB019** Wildcard	
Module code	MMB019
Module title (German)	Wildcard
Module title (English)	Wildcard
Person responsible for the module	Professors of Microbiology
Prerequisites for admission to the module	1 Compulsory module: Basic module
Prerequisite for what other modules	Project and Specialization module
Type of module (compulsory module, required elective module, elective module)	Required elective module
Frequency of offer (how often is the module offered?)	Every second semester (beginning in summer semester)
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P/S/E/L
ECTS credits	0 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	150/300 h 60/90 h 90/180 h
Content	Different events offered for students can be combined with 4 or 8 hpw and after a mandatory consultation heard as an extra module. The subjects must clearly pertain to one topic and complement the microbiological subjects of the master program.
Intended learning outcomes	To be agreed
Prerequisites for admission to the module examination	To be agreed
Requirements for awarding credit points (type of examination)	To be agreed (100 %)

Modul **MMB700** Specialisation module	
Module code	MMB700
Module title (German)	Vertiefungsmodul
Module title (English)	Specialisation module
Person responsible for the module	Professors of Microbiology
Prerequisites for admission to the module	2 Compulsory modules: Basic modules 1 Required elective module
Prerequisite for what other modules	Master thesis
Type of module (compulsory module, required elective module, elective module)	compulsory module
Frequency of offer (how often is the module offered?)	Every semester
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P; S to research subjects
ECTS credits	15 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	450 h 300 h 150 h
Content	In the module, a research area is selected and the technical preparation of the Master thesis is performed. The tutorial research work contains elaboration of literature data and experimental lab work on a special topic of microbiology, that is part of the current research work of the institution offering the module. It also includes that the students are learning good scientific practise, critical literature survey, or working legis arte in microbiology. The students repeat the essentials by teaching first semester students under the observation of the course leader in module 001 "Introduction into Microbiology".
Intended learning outcomes	Microbiology techniques; orientation on research subject. The learned technical skills and scientific practices are applied to a first teaching experience and in a scientific subject. Therefore, teaching first semester students in the first week of studies with a practical course is part of this module. Regular participation in the practical course and the seminar is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none

Requirements for awarding credit points (type of examination)	Outline and time table for Master thesis (passed)

Modul **MMB800** Project module	
Module code	MMB800
Module title (German)	Projektmodul
Module title (English)	Project module
Person responsible for the module	Professors of Microbiology
Prerequisites for admission to the module	2 Compulsory modules: Basic modules; 1 Required elective module
Prerequisite for what other modules	Master thesis
Type of module (compulsory module, required elective module, elective module)	Compulsory module
Frequency of offer (how often is the module offered?)	Every semester
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P; S to research subjects
ECTS credits	15 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	450 h 300 h 150 h
Content	The module serves as preparation for the Master thesis by carrying out research within a current research project. It is expected, that the project module is completed at the institution where the Master thesis is planned.
Intended learning outcomes	Preparing and independently carrying out research projects; orientation to research topics; integrative sight on microbiological topics. Regular participation in the working group seminar is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Scientific presentation (100 %)

Modul **MMB900** Master thesis	
Module code	MMB900
Module title (German)	Masterarbeit
Module title (English)	Master thesis
Person responsible for the module	Professors of Microbiology
Prerequisites for admission to the module	60 LP
Prerequisite for what other modules	not applicable
Type of module (compulsory module, required elective module, elective module)	Compulsory module
Frequency of offer (how often is the module offered?)	Every semester
Duration of module	1 semester
Module Components/Types of courses (lecture, practical course, lab, tutorial, exercise, seminar, internship, …)	P; S (1 hpw)
ECTS credits	30 CP
Work load: - In-class studying - Independent studying (incl. preparations for examination)	900 h 700 h 200 h
Content	The Master thesis demonstrates that the student is able to solve a problem in the field of microbiology within 6 months independently with scientific methods. The subject of the Master thesis is supervised by one of the module coordinators and must be cleared with him or her. Great importance is attached to carefully collecting, evaluating and interpreting data. The module trains the independent writing of a scientific paper and leads to self-dependent scientific work.
Intended learning outcomes	Independent development and evaluation of an experiment as well as writing a scientific paper. Regular participation in the working group seminar is required to reach the study objectives of the module. The teaching staff will inform about further details at the beginning of the courses.
Prerequisites for admission to the module examination	none
Requirements for awarding credit points (type of examination)	Master thesis (100 %)

Abbrevations:

Abbrevations of lectures

IL....	Inaugural lecture
WG....	Working group
AM....	Advanced module
Exh....	Exhibition
BM....	Basic module
BzPS....	Begleitveranstaltung zum Praxissemester
C....	Consulting
To....	Tour
M....	Meeting
Blo....	Blockage
BC....	Block course
DV....	Slide show
IN....	Introductory session
RS....	Registrations
EC....	Exam course
EX....	Excursion
Exp....	Experiment/survey
FE....	Celebration/festivity
MS....	Movie screening
FEx....	Field exercise
BC....	Basic course
MaS....	Main seminar
MS/ BC....	Main seminar/block course
MaS/ Ex....	Main seminar/exercise
Inf....	Information session
IDS/E....	Interdisciplinary main seminar/exercise
E....	Exam
E/T....	Exam/test
C....	Colloquium
C/I....	Colloquium/practical work
CS....	Conference/symposium
kV....	Kulturelle Veranstaltung
Co....	Course
Cu....	Course

Abbrevations of lectures

Lag....	Lagerung
TRP....	Training research project
RC....	Reading course
M....	Module
ME....	Musical event
AS....	Advanced seminar
OnS....	Online seminar
OnL....	Online lecture
P....	Practical work
I/S....	Practical work/seminar
PM....	Practice module
Sa....	Sample
PJ....	Project
PPD....	Propaedeutic
PS....	Proseminar
EPr....	Exam preparation
CSA....	Cross-sectional area
RE....	Revision course
LS....	Lecture Series
TC....	Training course
S....	Seminar
S/E....	Seminar/Excursion
S/E....	Seminar/Exercise
ST....	Service time
SI....	Conference
SuSch....	Summer school
MISC....	Miscellaneous
OE....	Other event
LC....	Language course
Con....	Convention
TT....	Teleteaching
MN....	Meeting
Tu....	Tutorial
T....	Tutorial
E....	Exercise
E/BC....	Exercise/block course
E....	Exercises
E/I....	Exercise/interdisciplinary
E/I....	Exercise/practical work
E/T....	Exercise/tutorial

Abbrevations of lectures

Conf....	Conference
ViCo....	Video conference
L....	Lecture
L/C....	Lecture with colloquium
L/I....	Lecture/practical work
L/S....	Lecture/seminar
L/E....	Lecture/exercise
TK....	Talk
Sp....	Speech
OS....	Optional seminar
OL....	Optional lecture
Tr....	Training
WOS....	Workshop
Wo....	Workshop
CAC....	Certificate award ceremony

Other Abbrevations

Anm.....	Anmerkung
ASQ....	Allgemeine Schlüsselqualifikationen
AT....	Altes Testament
E....	Essay
FSQ....	Fachspezifische Schlüsselqualifikationen
FSV....	Fakultät für Sozial- und Verhaltenswissenschaften
GK....	Grundkurs
IAW....	Institut für Altertumswissenschaften
LP....	Leistungspunkte
NT....	Neues Testament
SQ....	Schlüsselqualifikationen
SS....	Sommersemester
SWS....	Semesterwochenstunden
TE....	Teilnahme
TP....	Thesenpublikation
ThULB....	Thüringer Universitäts- und Landesbibliothek
VVZ....	Vorlesungsverzeichnis
WS....	Wintersemester