JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Faculty 09

Summer Semester 2026

As of 12.03.2026

# Module Directory

Faculty 09 - Agricultural Sciences, Nutritional Sciences and Environmental Management

## "Agrobiotechnology" Master Degree Course Modules

Please consult the timetable or current university calendar for information regarding dates and room numbers of the modules taught in the course:

http://www.uni-giessen.de/cms/fbz/fb09/studium/msc/stpl

## Core Modules

| MK-002-EN | MK-002-EN Applied Statistics<br>Applied Statistics | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II<br>Offered for the first time: WS 2015/16<br>Intake capacity: not limited | 1. Sem.; |

**Frequency and Duration:** WS, 1 semester

**Module Coordinator:** Chair of Biometry and Population Genetics

**Applies to the Study Programmes:** Agrobiotechnology, Master (1.); Insect Biotechnology and Bioresources, Master (1.); Agrobioinformatics, Master (1.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The Students
- have knowledge of statistical methods;
- have knowledge of experimental designs;
- are able to analyse experiments and studies.

**Module Content:**
- Analysis of variance
- Comparison of treatments
- Mixed linear models
- Experimental designs
- Data analysis using statistical software

| Forms of Instruction: | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | | |
| Practical training | 30 | 60 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MK-011-EN | **MK-011-EN Lab Course Biochemistry** | 6 CP |
|---|---|---|
| | **Lab Course Biochemistry** | |
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Nutritional Sciences | 1. Sem.; |
| | Offered for the first time: SS 2016 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Biochemistry and Molecular Biology

**Applies to the Study Programmes:** Agrobiotechnology, Master (1.);

**Prerequisites for Participation:** None (recommended: knowledge in chemistry and Biochemistry)

**Learning Outcomes:**
The Students

- have knowledge and proficiency in the application of molecular biology, spectrophotometric and chromatographic methods;
- are experienced and proficient in techniques of protein biochemistry and cell biology;
- have knowledge of the qualitative and quantitative value of biochemical, cell biological, molecular biological, and enzymatic analytic processes.

**Module Content:**

- primer design, PCR, cloning, use of restriction enzymes, ligation into vectors
- transformation of Escherichia coli
- heterologous overexpression of genes relevant to agrobiotechnology
- production of recombinant proteins in genetically altered bacteria
- purification of proteins with affinity chromatography
- SDS-PAGE analysis and Coomassie staining for detection and quality of control of recombinant proteins
- spectrophotometric analysis
- Functional assays for chaperone activity
- crystallization of proteins, x-ray diffraction analysis and alternative methods of structure determination

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | | |
| Seminar | 20 | 40 |
| Practical training | 40 | 80 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MK-015-EN | MK-015-EN Plant Protection and Bioengineering | 6 CP |
|---|---|---|
| | **Plant Protection and Bioengineering** | |
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology | 1./2. Sem.; 3./4. Sem.; |
| | Offered for the first time: WS 2015/16 | |
| | Intake capacity: not limited | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Phytopathology

**Applies to the Study Programmes:** Agrobiotechnology, Master (1./2.); Profil Agrobioinformatics, Master (3./4.);

**Prerequisites for Participation:** None (recommended: Basic knowledge in plant pathology and molecular biology)

**Learning Outcomes:**
The Students
- are able to understand and evaluate industrial strategies for disease control;
- have experience with basic biotechnological processes, such as tissue culture, high-throughput screening and pesticide applications;
- have a conception of the implementation impacts of plant biotechnology;
- have a command of the most important transformation techniques in the production of genetically modified plants;
- have a theoretical background of the biological mechanismus modern plant protection is based on.

**Module Content:**
- transgenic plants
- agronomically significant genes
- biotechnological disease control techniques
- tissue techniques and tissue cultures
- high-throughput screening methods
- industrial strategies in plant protection

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 40 | 70 |
| Seminar | 30 | 40 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and presentation (10-20 min.)
- Components of final grade: Written examination (75 %) and presentation (25 %)
- Form of module retake examination: Oral examination or written examination

**Language:** English

| MK-016-EN | **MK-016-EN Biotechnology and Genomics**<br>**Biotechnology and Genomics** | **6 CP** |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I<br>Offered for the first time: SS 2016<br>Intake capacity: not limited | 2. Sem.; |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Plant Breeding

**Applies to the Study Programmes:** Agrobiotechnology, Master (2.);

**Prerequisites for Participation:** None (recommended: Knowledge of molecular genetics)

**Learning Outcomes:**
The students
- have deep theoretical knowledge about genome analysis methods methods, with an emphasis on plant genome mapping and gene expression techniques;
- gain insight into the practical applications of biotechnological and molecular genetic methods in plant breeding;
- have the necessary theoretical background to apply experimental molecular genetics, biotechnological and gene technological methods in plant breeding.

**Module Content:**
- Molecular and cellular plant genetics
- Methods and techniques of experimental biotechnology and genome analysis
- Molecular plant breeding: Structure and function of plant genomes, molecular markers, genome mapping, QTL analysis, gene cloning techniques, gene expression methodology
- Methods of gene technology in plant breeding: Gene isolation, gene transfer (transformation techniques), detection methods

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 50 | 90 |
| Seminar | | |
| Practical training | | |
| Exercises | | |
| Excursion | 20 | 20 |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and seminar paper (4 pages)
- Components of final grade: Written examination (80%), seminar paper (20%)
- Form of module retake examination: Written examination

**Language:** English

<table>
<tr><td rowspan="2">MK-018-EN</td><td>MK-018-EN Microbial Food Biotechnology</td><td rowspan="2">6 CP</td></tr>
<tr><td>Microbial Food Biotechnology</td></tr>
<tr><td rowspan="3">Core Module / Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Applied Microbiology</td><td rowspan="3">2./4. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2016</td></tr>
<tr><td>Intake capacity: 30</td></tr>
<tr><td colspan="3">Frequency and Duration: SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Microbiology of Recycling Processes</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Agrobiotechnology, Master (2./4.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:<br>Students<br>• will have knowledge of the industrial microbiological processes employed in industrial settings, including genetic engineering applications;<br>• be familiar with advanced application-oriented microbiological methods within the scope of industrial microbiology;<br>• know basic and advanced microbiologcal and molecular techniques for control purposes.</td></tr>
<tr><td colspan="3">Module Content:<br>• food fermentations, Selected examples: Dairy products, wine, beer, fermented vegetables<br>• microbial production systems, Vinegar, citric acid, acetone, amino acids as primary products of microbial metabolism<br>• antibiotics, toxins (e.g. as insecticides) as secondary products of microbial metabolism<br>• microbial transformation and biocatalysis<br>• genetic engineering of microorganisms for optimal production<br>• foodborne pathogenic bacteria, Selected examples: Salmonella, enterohemorrhagic bacteria, Clostridium<br>• epideminology of foodborne illness<br>• Insects and other vectors for microbial spoilage<br>• Inhibition of microbial growth by physical or chemical methods<br>• Diagnostics in the food quality control (microbial contamination), micro- and molecular microbiological methods (selective pathogen cultivation), phylogenetic identification (Sangersequencing, 16S rRNA gene sequence analysis), epidemiological analysis of pathogens (MLST), resistance profiling, determination of toxicity and virulence genes, quantitative PCR, Salmonella diagnostics</td></tr>
</table>

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | | |
| Practical training | 30 | 60 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination and report of the practical exercises (5-7 pages)
- Components of final grade: Written examination (80 %), report of the practical exercises (20 %)
- Form of module retake examination: Written examination

**Language:** English

| MK-057-EN | MK-057-EN Molecular Phytopathology<br>Molecular Phytopathology | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology<br>Offered for the first time: WS 2015/16<br>Intake capacity: not limited | 1. Sem.;<br>1./2. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Phytopathology

**Applies to the Study Programmes:** Agrobiotechnology, Master (1.); Nutzpflanzenwissenschaften, Master (1./2.); Oenologie, Master (1./2.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- have in-depth knowledge of the biochemical and molecular basis on host-parasite interactions;
- are able to describe the structure and function of the plant's immune system of model plants;
- are able to discuss possible means by which plants and their parasites coevolved.

**Module Content:**
- cytological, biochemical and molecular biological foundations background on host-parasite interactions
- mechanisms of plant defensive reactions
- structure and function of resistance and virulence genes
- principles of modern disease control processes on the basis of induced resistance and genetic engineering techniques
- effector biology, PAMP-triggered immunity, effector triggered immunity

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 60 | 120 |
| Seminar | | |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Oral examination or written examination

**Language:** English

<table>
<tr><td rowspan="2">MK-116-EN</td><td>MK-116-EN Principles of Scientific Practice</td><td rowspan="2">6 CP</td></tr>
<tr><td>Principles of Scientific Practice</td></tr>
<tr><td rowspan="3">Core Module /<br>Optional Module</td><td>Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I</td><td rowspan="3">1. Sem.;<br>2. Sem.;</td></tr>
<tr><td>Offered for the first time: SS 2021</td></tr>
<tr><td>Intake capacity: not limited</td></tr>
<tr><td colspan="3">Frequency and Duration: WS and SS, 1 Semester</td></tr>
<tr><td colspan="3">Module Coordinator: Chair of Agrobioinformatics</td></tr>
<tr><td colspan="3">Applies to the Study Programmes: Agrobiotechnology, Master (1.); Insect Biotechnology and Bioresources, Master (2.); Agrobioinformatics, Master (1.);</td></tr>
<tr><td colspan="3">Prerequisites for Participation: None</td></tr>
<tr><td colspan="3">Learning Outcomes:<br>The students<br>• understand principles of scientific methods, scientific recording and scientific reporting;<br>• are able to formulate testable research hypotheses and design experiments to answer scientific questions;<br>• understand requirements and reporting standards for statistical analysis;<br>• understand how to generate and communicate scientific knowledge;<br>• are familiar with guidelines for good scientific practise;<br>• are able to locate reliable, quality-assured information representing the accepted status quo in regard to a specific scientific question;<br>• are able to correctly use and cite scientific sources in written work and presentations.</td></tr>
<tr><td colspan="3">Module Content:<br>• Scientific methods<br>• Scientific hypotheses<br>• Experimental design<br>• Generation, recording and communication of scientific knowledge<br>• Good scientific practice<br>• Types and sources of scientific information</td></tr>
</table>

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | 10 | 20 |
| Practical training | | |
| Exercises | 20 | 40 |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Assignment (9 tasks), oral presentation (15 - 20 min.) and written assignment (2500 - 3000 words) or written examination or oral examination
- Components of final grade: Assignment (25 %), oral presentation (25 %) and written assignment (50 %) or written examination (100 %) or oral examination (100 %)
- Form of module retake examination: Revision of the written assignment or written examination or oral examination

**Language:** English

| MK-124-EN | MK-124-EN Nutritional Physiology of Crop Plants<br>**Nutritional Physiology of Crop Plants** | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Plant Nutrition<br>Offered for the first time: WS 2022/23<br>Intake capacity: 30 | 1./2. Sem.; 2. Sem. |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Plant Nutrition

**Applies to the Study Programmes:** Nutzpflanzenwissenschaften, Master (1./2.); Agrobiotechnology, Master (2.)

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- know the nutrient acquisition and transport mechanisms of crop plants;
- have sound knowledge of the physiological functions of plant nutrients, of photosynthesis and of plant energy metabolism;
- understand the role of nutrients for yield formation and the related physiological processes;
- can diagnose nutrient deficiency symptoms in crop plants.

**Module Content:**
- Nutrient acquisition and transport
- Diagnosis of nutrient deficiency
- Plant water relations
- Photosynthesis
- Energy metabolism of plants
- Nitrogen and sulfur assimilation
- Source-sink relations
- Storage processes

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 45 | 90 |
| Seminar | | |
| Practical training | 15 | 30 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Oral exam and seminar paper (2000 - 2500 words; 4-6 weeks)
- Components of final grade: Oral exam (75 %), seminar paper (25 %)
- Form of module retake examination: Oral exam

**Language:** English

## Profile Modules

| MK-068-EN | MK-068-EN Empirical Research Methods<br>Empirical Research Methods | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agricultural Policy and Market Research<br>Offered for the first time: WS 2015/16<br>Intake capacity: not limited | 1. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Agricultural, Food and Environmental Policy

**Applies to the Study Programmes:** Transition Management, Master (1.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- have acquired knowledge of general principles of various qualitative and quantitative research methods as well as evaluation research
- are able to understand the application of various methods with regard to research objectives

**Module Content:**
- Principles of applied statistics
- Correlation and causality
- Basic approach of econometrics
- Basic introduction to simple and multiple regression analysis
- Collecting and analysing panel data
- Designing of surveys, interviews, questionnaires
- Qualitative data collection techniques
- Qualitative data analysis
- Mixed methods

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | 30 | 60 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** Written examination or written examination, seminar paper (4-5 pages) and poster

**Module Examination:**
- Form(s) of assessment: Written examination (100 %) or written examination (70 %), seminar paper (15 %), poster (15 %)
- Components of final grade: Written examination
- Form of module retake examination:

**Language:** English

| MK-087-EN | MK-087-EN Natural Product Chemistry | 6 CP |
|---|---|---|
| | **Natural Product Chemistry** | |
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 1. Sem.; |
| | Offered for the first time: WS 2017/18 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Natural Substance Research with a Focus on Insect Biotechnology

**Applies to the Study Programmes:** Insect Biotechnology and Bioresources, Master (1.);

**Prerequisites for Participation:** None (recommended: knowledge in organic chemistry)

**Learning Outcomes:**
The students
- have comprehensive insight into the chemistry of organic natural products;
- know the most important classes of natural products, including their biosynthesis, important structural and chemical features as well as bioactivities.

**Module Content:**
- Bioresources (=origin), biosynthesis, ecophysiological role, and practical importance of natural products, thereby emphasizing insect-derived and 'anti-insect' compounds
- classes of natural products (carbohydrates, lipids, polyketides, phenylpropanoids, terpenes, peptides (non-ribosomally and ribosomally synthesized), and alkaloids) as well as their biosynthesis and important features (structure-activity relationships, toxicity)
- Methods section: Introduction to production/fermentation, isolation, purification of natural products (several (column) chromatographic techniques, especially HPLC), and structure elucidation

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | 30 | 60 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and presentation (10-15 min.)
- Components of final grade: Written examination (60 %), presentation (40 %)
- Form of module retake examination: Written examination or oral examination

**Language:** English

| MK-088-EN | MK-088-EN Entomology I<br>Entomology I | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology<br>Offered for the first time: WS 2017/18<br>Intake capacity: 30 | 1. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Applied Entomology

**Applies to the Study Programmes:** Insect Biotechnology and Bioresources, Master (1.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- gain fundamental knowledge of insects as a central bioresource;
- study insect anatomy and systematics;
- know the basics of insect identification and will learn ist practical application;
- learn techniques of preservation of insect specimens;
- understand the basics of evolutionary biology & ecology of insects.

**Module Content:**
- studies on internal (including dissections) and external insect morphology
- microscopy of organ systems
- use of insect identification keys with real specimens
- evolutionary strategies of insects
- insect ecology

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 40 | 80 |
| Seminar | | |
| Practical training | | |
| Exercises | 20 | 40 |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MK-089-EN | **MK-089-EN Insect Biotechnology and Integrated Pest Management** | 6 CP |
|---|---|---|
| | **Insect Biotechnology and Integrated Pest Management** | |
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 1. Sem.; |
| | Offered for the first time: WS 2017/18 | |
| | Intake capacity: 40 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Insect Biotechnology in Plant Protection

**Applies to the Study Programmes:** Insect Biotechnology and Bioresources, Master (1.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students

- have important knowledge in various methods of biological pest control (including classical biological control, inundative releases, etc.);
- have competencies in biology and ecology as well as the use of physical and microbiological control procedures;
- know the basic principles of important biotechnological plant protection strategies;
- can assess how and to what extent individual techniques can be used within the framework of IPM strategies;
- can independently compile, summarize, and present literature on a given topic in a lecture

**Module Content:**

- The legal basis of integrated and biological plant protection
- Biology and ecology of agricultural pests and entomopathogens and their application possibilities in crop protection (production and application technology)
- Case studies on methods of classical biological pest control, inundative releases of antagonists (in the field and greenhouse), sterile insect technology and strategies for the promotion of natural enemies in agricultural ecosystems
- Use of pheromones (monitoring, mass capture, confusion, lure and kill) and other biotechnological plant protection methods in agriculture

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 44 | 88 |
| Seminar | 8 | 16 |
| Practical training | | |
| Exercises | | |
| Excursion | 8 | 16 |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination and presentation (10-20 min. + discussion 5-10 min.)
- Components of final grade: Written examination (50%), presentation (50%)
- Form of module retake examination: Written examination or oral examination

**Language:** English

| MK-090-EN | MK-090-EN Bioresources for Natural Product Discovery<br>**Bioresources for Natural Product Discovery** | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology<br>Offered for the first time: SS 2018<br>Intake capacity: 30 | 2. Sem.; |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Natural Substance Research with a Focus on Insect Biotechnology

**Applies to the Study Programmes:** Insect Biotechnology and Bioresources, Master (2.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students

- gain insights into suitable bioresources for natural product discovery approaches and how discovery pipelines are set-up (biological activity-based platforms versus modern genomics / bioinformatics-driven pipelines);
- get knowledge in currently used and emerging natural product-producing microorganisms and their application in pharmaceutical, agricultural and food industry;
- acquire knowledge in the industrial value chain from spanning early discovery programs up to lead candidate identification and lead development;
- get experience in the application of bioinformatic tools for biosynthetic gene cluster identification;
- get insights into recent literature and acquire skills in selecting and presenting publications as well as other data in seminars.

**Module Content:**

- Systematics, biology, and ecology of microorganisms producing natural products
- Examples of plant-derived natural products
- Examples of natural products biosynthesis in microorganisms (physiology, gene regulation)
- From bioresource to product: Strategies to select and exploit bioresources for natural product discovery
- Principles and application of biological detection systems and their application in academic and industrial screening systems
- Target identification and target-based screening systems
- Analytical platforms in natural product identification
- Connection of gene clusters and metabolites: modern approaches for drug discovery
- Lead identification and strategies for lead development
- Seminar on recent approaches in drug discovery
- Demonstration / hands on training to gain insights into bioinformatics tools in drug discovery (using the antiSMASH platform as an example to exploit genome sequence information)

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 42 | 84 |
| Seminar | 9 | 18 |
| Practical training | | |
| Exercises | 9 | 18 |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination, presentation (10-15 min.) and project work (group work: preparation of a video tutorial, 4-10 min)
- Components of final grade: Written exam (50 %), presentation (40 %), project work (10 %)
- Form of module retake examination: Written examination or oral examination

**Language:** English

| MK-091-EN | MK-091-EN Entomology II<br>Entomology II | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology<br>Offered for the first time: SS 2018<br>Intake capacity: 30 | 2. Sem.; |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Applied Entomology

**Applies to the Study Programmes:** Insect Biotechnology and Bioresources, Master (2.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- gain in-depth knowledge on insect anatomy;
- broaden their knowledge on insect systematics;
- increase their skills in insect identification;
- understand concepts of insect physiology;
- understand insect adaptations to environmental pressures;
- extend their knowledge about insect ecological strategies.

**Module Content:**
- microscopic studies on histological sections of insect tissues
- identification of specimens on family and species level
- specific taxonomic techniques
- insect physiology (including development)
- examples and concepts how insects adapt to their environment
- insect feeding strategies (including field observations)

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 28 | 56 |
| Seminar | | |
| Practical training | | |
| Exercises | 24 | 48 |
| Excursion | 8 | 16 |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MK-119-EN | MK-119-EN Population Genetics<br>**Population Genetics** | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II<br>Offered for the first time: SS 2016<br>Intake capacity: not limited | 1./2. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Biometry and Population Genetics

**Applies to the Study Programmes:** Nutzpflanzenwissenschaften, Master (1./2.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- know important population genetical models;
- are able to analyse population genetical data;
- are able to model and simulate population genetical processes.

**Module Content:**
- Models for single loci: genotype and allele frequencies, inbreeding, drift, selection
- Models for several loci: genetic maps, linkage disequilibrium
- Models for populations: genetic distances and visualization
- Genome wide association studies

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | | |
| Practical training | 30 | 60 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100%)
- Form of module retake examination: Written examination

**Language:** English

| MP-016-EN | MP-016-EN Quality Assessment of Raw Plant Material<br>Quality Assessment of Raw Plant Material | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II<br>Offered for the first time: WS 2015/16<br>Intake capacity: 40 | 1.-4. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Agronomy and Crop Physiology

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil GT, WW, Master (1.-4.);

**Prerequisites for Participation:** None (recommended: Knowledge of crop production and plant foods)

**Learning Outcomes:**
The students

- possess in-depth knowledge of the chemical and nutritional composition of plant-based foods as well as industry-specific quality requirements;
- are able to independently conduct practical laboratory analyses on plant-based raw materials and professionally evaluate the results;
- have sound knowledge of measures and factors influencing the quality of plant-based foods during production and primary processing, including agricultural, environmental, genetic, and process-related aspects;
- understand the design and function of selected processing equipment and are familiar with their impact on the properties and quality of plant-based foods.

**Module Content:**

- Regulations, equipment, and ISO guidelines for sampling and sample division: Understanding of standards and the use of equipment for accurate and consistent sampling and sample division in accordance with ISO guidelines.
- Sensory evaluation of analytical materials: Conducting sensory assessments to evaluate and interpret the quality characteristics of analyzed materials.
- Indirect and direct methods for product quality analysis: Application of both indirect and direct analytical techniques to assess the quality parameters of various products.
- Quality requirements and quality assurance measures for plant-based raw materials: Comprehensive knowledge of quality standards and quality assurance practices for cereals, brewing and ethanol grains, oilseeds, edible legumes, table, starch and industrial potatoes, sugar crops, and specialty crops.
- Technological processes for the production of sugar beets and edible oil: Understanding of the technological workflows involved in the extraction and processing of sugar beets and the production of edible oils.

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | | |
| Practical training | 30 | 60 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100%)
- Form of module retake examination: Written examination

**Language:** English

| MP-029-EN | MP-029-EN Plant-Microbe Interactions | 6 CP |
|---|---|---|
| | **Plant-Microbe Interactions** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology | 2./4. Sem.; |
| | Offered for the first time: SS 2016 | |
| | Intake capacity: 60 | |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Phytopathology

**Applies to the Study Programmes:** Profil, Master (2./4.); Profil englisch, Master (2./4.);

**Prerequisites for Participation:** None (recommended: basics in microbiology and phytopathology)

**Learning Outcomes:**
The Students
- are familiar with interactions of parasitic and symbiotic biocenoses;
- are able to discuss the application of alternative measures for reduction of pesticide and chemical fertilizers;
- are familiar with concepts of modern interdisciplinary approaches to the use of microorganisms in disease control.

**Module Content:**
- physical and chemical conditions in the rhizosphere (pH, O2, exudate gradients)
- root pathogens (fungi, bacteria)
- pest control strategies on roots
- growth promotion of rhizospheric microorganisms (N2 fixation, regulation of the nif gene, plant-promoting factors, mycorrhiza)
- resistance mechanisms
- possibilities and limitations of inoculation with VAM or N2-fixing bacteria
- interaction with beneficial microorganisms (PGPR, BCAs)
- microbial interactions with lower plants (mosses, lichens, etc.)
- methods for the study of uncultivable microorganisms on/in plant tissues

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 45 | 90 |
| Seminar | 15 | 30 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and Presentation (10-20 min.)
- Components of final grade: Written examination (75 %), Presentation (25 %)
- Form of module retake examination: Oral or written examination

**Language:** English

| MP-076-EN | MP-076-EN Lab Course: Tissue Culturing and Genetic Transformation | 6 CP |
|---|---|---|
| | **Lab Course: Tissue Culturing and Genetic Transformation** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology | 1./3. Sem.; |
| | Offered for the first time: WS 2015/16 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, Block, 1 Semester

**Module Coordinator:** Chair of Phytopathology

**Applies to the Study Programmes:** Profil, Master (1./3.); Profil englisch, Master (1./3.);

**Prerequisites for Participation:** Molecular Phytopathology (MK 057), Plant Protection and Bioengineering (MK 015)

**Learning Outcomes:**
The Students

- have practical knowledge of the methods, strategies, and laboratory techniques for plant and microbe transformation;
- are able to understand technical problems related to genetic transformation of crop plants, and identify the risks involved in this strategy;
- have fundamental knowledge in risk assessment, environment protection, farmer and consumer protection, and food security.

**Module Content:**

- guidance for the risk management of genetic engineered plant and microorganisms
- practical training in plant transformation
- practical training in microbe transformation techniques
- practical training in tissue culturing techniques
- practical training in detection of transgenes by molecular and cell biology techniques
- practical training in confocal laser microscopy
- practical training in transgene function assessment

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 5 | 10 |
| Seminar | 5 | 10 |
| Practical training | 50 | 100 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Oral examination, seminar paper (8 pages)
- Components of final grade: Oral examination (50%), seminar paper (50%)
- Form of module retake examination: Oral examination

**Language:** English

| MP-077-EN | MP-077-EN Lab Course: Methods in Molecular Phytopathology | 6 CP |
|---|---|---|
| | **Lab Course: Methods in Molecular Phytopathology** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Phytopathology | 1./3. Sem.; |
| | Offered for the first time: WS 2015/16 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, Block, 1 Semester

**Module Coordinator:** Chair of Phytopathology

**Applies to the Study Programmes:** Profil, Master (1./3.); Profil englisch, Master (1./3.);

**Prerequisites for Participation:** Molecular Phytopathology (MK 057), Plant Protection and Bioengineering (MK 015)

**Learning Outcomes:**
The Students

- are acquainted with plant pathogenic organisms and will learn different inoculation techniques;
- know laboratory techniques in molecular biology;
- know different biotechnological strategies in plant protection;
- have a broad knowledge of plant microbe interactions;
- have knowledge about pathogen effector molecules and their targets in the host cell;
- have knowledge about protein-protein interactions.

**Module Content:**

- practical training in detection methods of DNA, RNA and proteins
- practical training in biotechnological plant protection strategies
- practical training in bioinformatics related to sequence similarities and diagnostic matter
- practical training in inoculation methods and disease assessment
- practical training in detection of protein-protein interactions

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 5 | 10 |
| Seminar | 5 | 10 |
| Practical training | 50 | 100 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Oral examination and presentation (10-20 min.)
- Components of final grade: Oral examination (50 %), presentation (50%)
- Form of module retake examination: Oral examination

**Language:** English

| MP-090-EN | MP-090-EN Biotechnology for Pest Control | 6 CP |
|---|---|---|
| | **Biotechnology for Pest Control** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 1./3. Sem.; |
| | Offered for the first time: WS 2015/16 | |
| | Intake capacity: 40 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Insect Biotechnology in Plant Protection

**Applies to the Study Programmes:** Profil, Master (1./3.); Profil englisch, Master (1./3.);

**Prerequisites for Participation:** None (recommended: basic knowledge in zoology, biotechnology, and genetics)

**Learning Outcomes:**
The Students

- get an introduction to insect biotechnology;
- know about biotechnological applications of insect-derived bioresources in medicine, agriculture, and industry;
- know about the importance of genetic and epigenetic tools in model insect species;
- know about diseases transmitted by insets and comparative genomic analysis;
- know how to synthesize and prepare the seminar work on insect biotechnology and molecular entomology.

**Module Content:**

- concepts of insect biotechnology and relevant basics in insect immunity, physiology and epigenetics
- application of insect-derived bioresources in medicine, agriculture and industry
- a detailed view on environment friendly methods of pest control including molecular, transgenic and gene editing technologies

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 36 | 72 |
| Seminar | 24 | 48 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**

- Form(s) of assessment: Written examination and presentation (7-20 min. + discussion 5-10 min.)
- Components of final grade: Written examination (50 %), presentation (50 %)
- Form of module retake examination: Oral examination or written examination or presentation

**Language:** English

| MP-098-EN | MP-098-EN Molecular Plant Breeding | 6 CP |
|---|---|---|
| | **Molecular Plant Breeding** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I | 1.-4. Sem.; |
| | Offered for the first time: WS 2015/16 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Plant Breeding

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

**Prerequisites for Participation:** Biotechnology and Genomics (MK 016) / (recommended: Plant Breeding: Special Topics of Resistance and Quality Breeding (MP 020))

**Learning Outcomes:**
The students
- will gain practical and/or theoretical experience in DNA and RNA extraction and analysis techniques, PCR, genetic mapping and QTL analysis, DNA hybridisation, gene expression and next-generation sequencing
- will learn practical applications of biotechnological and molecular genetic methods in plant breeding
- will obtain the necessary practical background to apply experimental molecular genetics, biotechnological and gene technological methods in plant breeding

**Module Content:**
- Next-generation DANN sequencing
- Molecular marker analysis, genome mapping and QTL analysis
- DNA filter hybridisation, genome libraries
- Quantitative real-time PCR
- New methods of gene technology in plant breeding: Genome editing, cis-genestics

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 30 |
| Seminar | | |
| Practical training | 40 | 80 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Oral examination and lab book (30-50 pages)
- Components of final grade: Oral examination (50 %), lab book (50 %)
- Form of module retake examination: Oral examination

**Language:** English

| MP-149-EN | MP-149-EN Molecular Techniques<br>Molecular Techniques | 6 CP |
|---|---|---|
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology<br>Offered for the first time: WS 2017/18<br>Intake capacity: 40 | 1./3. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Insect Biotechnology in Plant Protection

**Applies to the Study Programmes:** Profil, Master (1./3.); Profil englisch, Master (1./3.);

**Prerequisites for Participation:** None (good knowledge in genetics recommended)

**Learning Outcomes:**
The students
- have a basic knowledge of molecular biology;
- know important vector and plasmid systems;
- know important molecular pathways as well as cloning strategies;
- have a good knowledge of molecular techniques used in insect biotechnology.

**Module Content:**
- Fundamentals in molecular biology
- History and evolution of plasmids and DNA cloning
- Molecular biology and their benefits in biotechnology
- Transformation possibilities and transgenesis in insects
- "From plasmids to biotechnologically modified insects"
- Current molecular tools in insect biotechnology and their risk assessment

| Forms of Instruction: | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 28 | 56 |
| Seminar | 24 | 48 |
| Practical training | | |
| Exercises | 8 | 16 |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MP-150-EN | MP-150-EN Milestones of Insect Biotechnology & Bioresources | 6 CP |
|---|---|---|
| | **Milestones of Insect Biotechnology & Bioresources** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 2./4. Sem.; |
| | Offered for the first time: SS 2018 | |
| | Intake capacity: 40 | |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Insect Biotechnology in Plant Protection

**Applies to the Study Programmes:** Profil, Master (2./4.); Profil englisch, Master (2./4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- have an overview of currently discussed relevant topics in science and industry in the field of insect biotechnology;
- have an overview of currently discussed relevant topics in science and industry in the field of bioresources;
- Get an overview of research and presentation of current relevant publications and discussion within the context of the lecture, classification of potential industrial and social relevance.

**Module Content:**
- Discussion of regulatory and ethical topics on the use of insect biotechnology and the generation of novel products for pest control and human health
- presentation and discussion of currently important topics in insect biotechnology & bioresources
- literature research and presentation of currently relevant topics in pharmaceutical and industrial biotechnology based on publications

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 54 | 108 |
| Seminar | | |
| Practical training | | |
| Exercises | | |
| Excursion | 6 | 12 |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MP-151-EN | MP-151-EN Antibiotics: Present, Past and Future | 6 CP |
|---|---|---|
| | **Antibiotics: Present, Past and Future** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 2.-4. Sem.; |
| | Offered for the first time: WS 2018/19 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Natural Substance Research with a Focus on Insect Biotechnology

**Applies to the Study Programmes:** Profil, Master (2.-4.); Profil englisch, Master (2.-4.);

**Prerequisites for Participation:** Natural Product Discovery Platforms (MK 090)

**Learning Outcomes:**
The students
- get comprehensive insight into the main chemical classes of antibiotics used in human and veterinary medicine as well as for agricultural applications.

**Module Content:**
- Main chemical classes (ß-lactams, tetracyclins, aminoglycosides, macrolides, peptide antibiotics, 'hybrid' structures, others) of antibiotics used in human and veterinary medicine as well as for agricultural applications;
- Microbial secondary metabolism as the primary source of antibiotics, including biosynthesis of the most important classes;
- Modes of action and target sites of important classes of antibiotics;
- Resistance to antibiotics and novel strategies to overcome antibiotic resistance;
- Optimizing the effectiveness of antibiotics by chemical and biosynthetic modification (partial synthesis, precursor-directed biosynthesis etc.);
- Design & optimization of antibiotic fermentation processes;
- History of antibiotic research and to antimicrobial metabolites from other than microbial sources;

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 48 | 96 |
| Seminar | 12 | 24 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination, presentation (10-15 min.) and project work (group work: video tutorial, 4-10 min. or written coursework, 1500-2000 words)
- Components of final grade: Written examination (50 %), presentation (30 %), project work (20 %)
- Form of module retake examination: Written examination or oral examination

**Language:** English

| MP-158-EN | MP-158-EN Insects for Food and Feed Production Systems | 6 CP |
|---|---|---|
| | **Insects for Food and Feed Production Systems** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology | 1.-4. Sem.; |
| | Offered for the first time: WS 2018/19 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Applied Entomology

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- learn analytical procedures used in the area of food and feed
- gain insight into processing systems for food production
- learn to identify edible insects and get information about their morphology, physiology, and ecology
- gain knowledge on strategies to convert waste to food
- present their research results in the form of a seminar talk

**Module Content:**
- biology of edible insects and introduction to different insect rearing systems
- basic methods used in modern food analysis
- Analysis of available databases and literature for suitable insects, protein requirements and improved waste management

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 42 | 84 |
| Seminar | 18 | 36 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and presentation (15 min.)
- Components of final grade: Written examination (75%), presentation (25%)
- Form of module retake examination: Written examination

**Language:** English

| MP-196 | MP-196 Internship<br>Berufspraktikum | 12 CP |
|---|---|---|
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management /<br>Offered for the first time: WS 2019/20<br>Intake capacity: not limited | 1. - 4. Sem.; |

**Frequency and Duration:** WS and SS, 1 Semester

**Module Coordinator:** Study deanery

**Applies to the Study Programmes:** Profil englisch, Master (1. - 4.); Profil, Master (1. - 4.);

**Prerequisites for Participation:** Keine

**Learning Outcomes:**
The Students
- gain in-depth experience as interns in future fields of activity and professions;
- have practical knowledge and skills from their internship companies and understand the connection between study and practice;
- concretise their personal career perspectives (career planning).

**Module Content:**
- Development of future occupational fields
- Practical experience in companies in the fields of agricultural sciences, environmental sciences, ecotrophology and nutritional sciences
- Reflection on one's own practical professional activity

| Forms of Instruction: | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | | |
| Seminar | | |
| Practical training | 360 | |
| Exercises | | |
| Excursion | | |
| Total: | 360 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Internship report (tasks, activities, acquired knowledge and skills, reflection). The report must be assessed as "passed".
- Components of final grade: Formation of the module mark: ungraded performance
- Form of module retake examination: Revision of the internship report

**Language:** German and/or English

| MP-234-EN | MP-234-EN Crop Abiotic Stresses | 6 CP |
|---|---|---|
| | **Crop Abiotic Stresses** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I | 1.-4. Sem.; |
| | Offered for the first time: SS 2022 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Agronomy and Crop Physiology

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- are able to understand the cause of abiotic stresses occurring in crops production;
- know how to design experiments to evaluate the performance of different genotypes under specific stress conditions;
- know how to monitor plant physiological parameters including photosynthesis, leaf spectral reflectance and development;
- are able to conduct physiological and biochemical analyses on plant samples in the lab;
- are able to perform statistical analyses on the data from screening experiments to understand the effects of treatment, genotype and treatment by genotype interaction;
- know how to design scientific posters and write reports for presenting research results.

**Module Content:**
- Responses to abiotic stressesIn of rice and maize
- different types of abiotic stresses (drought, submergence, salinity, iron toxicity and cold)
- screening experiments under the stress conditions
- phenotyping devices to evaluate the performance of plants under optimal and stress conditions
- physiological and biochemical analyses

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | | |
| Seminar | 10 | 20 |
| Practical training | 30 | 60 |
| Exercises | 20 | 40 |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** Attendance rate of the practical activities must be more than 90%.

**Module Examination:**
- Form(s) of assessment: Poster with presentation (max. 10 minutes) and seminar paper (8-12 pages)
- Components of final grade: Poster with presentation (50 %), seminar paper (50 %)
- Form of module retake examination: Revision of the seminar paper

**Language:** English

| MP-235-EN | MP-235-EN Practical Genome Sequencing and Bioinformatics | 6 CP |
|---|---|---|
| | **Practical Genome Sequencing and Bioinformatics** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I | 1.-4. Sem.; |
| | Offered for the first time: SS 2022 | |
| | Intake capacity: 30 | |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Agrobioinformatics

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

**Prerequisites for Participation:** Biotechnology and Genomics (MK-016-EN) oder Analysis of DNA and RNA Sequencing Data (MK-128-EN)

**Learning Outcomes:**
The students
- are familiar with practical experimental techniques related to genome sequencing and genomic data analysis;
- know how to extract plant DNA samples and check DNA quality using standard molecular biology techniques;
- know the principles for generating DNA libraries suitable for high-throughput DANN sequencing;
- know how analyse resulting genomic data using bioinformatics methodologies;
- are familiar with the Linux operating system and high performance computing necessary for bioinformatics analysis;
- know the principles of scientific record keeping and lab reporting based on the experiments performed.

**Module Content:**
- DNA extraction
- DNA quantification using RT-PCR
- Library preparation
- High-throughput DNA sequencing
- Bioinformatics analysis of sequencing data
- Molecular biology quality control techniques (PCR, gel electrophoresis, etc)
- Production of lab books and practical reports

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 10 | 20 |
| Seminar | | |
| Practical training | 50 | 100 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** Participation in laboratory classes

**Module Examination:**
- Form(s) of assessment: Seminar paper (3000 words minimum) and lab book (4 to 6 experiments)
- Components of final grade: Seminar paper (60 %), lab book (40 %)
- Form of module retake examination: Revision of seminar paper and lab book

**Language:** English

| MP-236-EN | MP-236-EN Quantitative Genetics | 6 CP |
|---|---|---|
| | **Quantitative Genetics** | |
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II | 1.-4. Sem.; |
| | Offered for the first time: SS 2022 | |
| | Intake capacity: not limited | |

**Frequency and Duration:** SS, 1 Semester

**Module Coordinator:** Chair of Biometry and Population Genetics

**Applies to the Study Programmes:** Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- know quantitative genetic models to decompose the genotypic value;
- understand the basics of quantitative inheritance and genome-wide prediction;
- understand models of selection theory;
- can estimate the expected response to selection.

**Module Content:**
- Additive, dominance, and epistasic effects
- Performance prediction of selection candidates
- Estimation of variance components and heritability
- Direct selection, indirect selection, multistage selection, index selection

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | | |
| Practical training | 30 | 60 |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Assignments (4) or written examination
- Components of final grade: Assignments (100 %) or written examination (100%)
- Form of module retake examination: Written examination

**Language:** English

| MP-248-EN | MP-248-EN Fruit Breeding<br>Fruit Breeding | 6 CP |
|---|---|---|
| Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding II<br>Offered for the first time: WS 2022/23<br>Intake capacity: 30 | 1.-4. Sem.; |

**Frequency and Duration:** WS, 1 Semester

**Module Coordinator:** Chair of Biometry and Population Genetics

**Applies to the Study Programmes:** Profil, Master (1.-4.); Profil englisch, Master (1.-4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The students
- have insight into the objectives and peculiarities of fruit breeding;
- have knowledge on the origin, evolution and domestication of the most important European fruit species;
- have broad application knowledge of processes of species specific breeding programs.

**Module Content:**
- History, economic significance and methods of fruit breeding
- Plant variety protection and marketing of plant material
- Phylogenetic origin of important fruit species
- The use of genetic resources for fruit breeding
- State of the art fruit breeding technologies
- Fruit breeding explained with selected examples

| Forms of Instruction: | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 36 | 72 |
| Seminar | 6 | 12 |
| Practical training | 6 | 12 |
| Exercises | 4 | 8 |
| Excursion | 8 | 16 |
| Total: | 180 | |

**Prerequitistes for Examination:** Written assignement (protocol and questionnaire, 4 pages within 2 weeks)

**Module Examination:**
- Form(s) of assessment: Written examination
- Components of final grade: Written examination (100 %)
- Form of module retake examination: Written examination

**Language:** English

| MP-263-EN | **MP-263-EN Technologies for Resistance and Stress Tolerance Breeding**<br>**Technologies for Resistance and Stress Tolerance Breeding** | **6 CP** |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Agronomy and Plant Breeding I<br>Offered for the first time: SS 2026<br>Intake capacity: not limited | 1.-4. Sem.;<br>3./4. Sem.; |

**Frequency and Duration:** SS, 1 semester

**Module Coordinator:** Chair of Plant Breeding

**Applies to the Study Programmes:** Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

**Prerequisites for Participation:** None (recommended: prior knowledge of plant breeding)

**Learning Outcomes:**
The Students
- possess advanced knowledge of disease resistance and abiotic stress tolerance in major crop plants;
- are able to accurately quantify and describe resistances and tolerances;
- are familiar with methods for assessing relevant traits in research, breeding, and official variety testing;
- are able to evaluate the potential and limitations of digital, non-invasive phenotyping approaches;
- understand genotype–environment–management interactions and their effects on plant traits;
- know how resistances and tolerances can be selectively improved through plant breeding.

**Module Content:**
- Phytopathological and genetic fundamentals of resistance to pests and diseases in major crop plants
- Plant genetic resources as natural sources of resistance and tolerance traits
- Methods for assessing resistance and evaluating its effectiveness
- Genotype × environment × management interactions affecting diseases and abiotic stress factors
- Application of digital phenotyping methods for non-invasive trait assessment
- Research strategies for determining the phytopathological and genetic architecture of resistance (various omics approaches and different genetic mapping methods)

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 40 | 80 |
| Seminar | 16 | 32 |
| Practical training | | |
| Exercises | | |
| Excursion | 4 | 8 |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Written examination and Presentation
- Components of final grade: Written examination (80%), Presentation (20%)
- Form of module retake examination: Written examination (80%), Presentation (20%)

**Language:** English

| MP-268-EN | MP-268-EN Animal Venomics<br>Animal Venomics | 6 CP |
|---|---|---|
| Core Module / Optional Module | Agricultural Sciences, Nutritional Sciences, and Environmental Management / Department of Insect Biotechnology<br>Offered for the first time: SS 2026<br>Intake capacity: 30 | 1.-4. Sem.; |

**Frequency and Duration:** SS, 1 semester

**Module Coordinator:** Chair of Applied Entomology

**Applies to the Study Programmes:** Profil englisch, Master (1.-4.); Profil, Master (1.-4.);

**Prerequisites for Participation:** None

**Learning Outcomes:**
The Students
- have an in-depth understanding of the concepts and mechanisms of animal venomics;
- understand the biochemistry from genes to proteins and higher-level biological processes;
- are familiar with fundamental bioanalytical methods, from sample preparation to legal considerations;
- recognize the importance of biological resources, from basic research to the One Health approach;
- are able to communicate and discuss scientific information across disciplines.

**Module Content:**
- Fundamentals and methodology of animal venomics
- Bioecological background of venoms and toxins
- Basics of molecular and genetic evolutionary biology
- Fundamentals of bioanalytics (from genomics to metabolomics)
- Applied and translational science

| **Forms of Instruction:** | Contact hours | Preparation and follow-up work |
|---|---|---|
| Lecture | 30 | 60 |
| Seminar | 30 | 60 |
| Practical training | | |
| Exercises | | |
| Excursion | | |
| Total: | 180 | |

**Prerequitistes for Examination:** None

**Module Examination:**
- Form(s) of assessment: Oral examination
- Components of final grade: Oral examination (100%)
- Form of module retake examination: Oral examination

**Language:** English