

The English version of this curriculum is not legally binding and is for informational purposes only.
The legal basis is regulated in the curriculum published in the University of Innsbruck Bulletin on 29 April 2008, issue 37, No. 266.

Curriculum for the
Master's Degree Programme in Microbiology
at the Faculty of Biology of the University of Innsbruck

§ 1 Qualification profile

- (1) The Master's Degree Programme in Microbiology belongs to the group of studies in the Natural Sciences.
- (2) The objective of the Master's Degree Programme in Microbiology at the University of Innsbruck is to provide a well-founded education in the basic subjects as well as in the fields of application of Microbiology. Particular focus is put on the acquisition of basic theoretical and methodological specialised knowledge, scientific thinking and working skills and the promotion of an understanding for complex biological relationships. In addition, creative interdisciplinary thinking and problem solving skills are promoted. The Master's Degree Programme also prepares students for doctoral studies.
- (3) Graduates of the programme have career prospects in the following fields:
 - Scientific activity and management positions in private and public companies and institutions (e.g. in the fields of biotechnology, food processing and control, pharmacy, medicine, hygiene, agriculture and forestry, environmental protection and conservation, public administration), in museums, in libraries and in nature reserves and conservation areas.
 - Activities as an expert or consultant for private and public companies (e.g. in the fields of biotechnology, medicine and hygiene, agriculture and forestry, and water management)
 - Research and teaching at universities and other national and international educational institutions.

§ 2 Duration and scope

- (1) A total of 120 ECTS credits are awarded for the Master's Degree Programme in Microbiology. This equals duration of 4 semesters. One ECTS credit equals a workload of 25 hours.

§ 3 Admission

- (2) Completion of a relevant University Bachelor Programme or a relevant Bachelor Programme at a university of applied science, or completion of other equivalent studies at an accredited Austrian or non-Austrian post-secondary educational institution is required for admission to the Master's Degree Programme.
- (3) Completion of the Bachelor Programme in Biology at the University of Innsbruck shall be deemed relevant for the purposes of para. 1 in any case.

§ 4 Types of courses and maximum number of students per course

- (1) With the exception of lectures (VO), all courses are courses with continuous performance assessment. Decisive factors for the maximum number of students per course and the necessary support and mentoring to students are safety aspects, available space, and necessary equipment.
- (2) Courses are divided into the following types:
 1. **Lecture** (VO): In this type of course, significant content and schools of thought of a special area are presented and explained by a lecturer. Maximum number of students per course: 300
 2. **Practical course** (UE): Practical courses enable participants to study and apply scientific knowledge and working methods in practice. Maximum number of students per course: 6-8
 3. **Lecture with integrated practical parts** (VU): Integrated course where lecture parts are combined with practical parts. Maximum number of students per course: 6
 4. **Seminar** (SE): In guided self-study programmes, including lecture presentations, written contributions and/or scientific discussions, students reflect on subject matter and methods of a special area. Maximum number of participants: 12-30
 5. **Project study** (PJ): In these courses, selected scientific methods are applied in special projects. Maximum number of students per course: 10
 6. **Excursion** (EX): In excursions, issues and problems of a subject are demonstrated and treated outside the premises of the university. Maximum number of students per course: 20
 7. **Excursion with integrated practical parts** (EU): Integrated course where a field trip is combined with practical parts. Maximum number of students per course: 10

§ 5 Procedure for the allotment of places in courses with a limited number of participants

The following criteria shall be applied for the allotment of places in courses with a limited number of participants:

1. Presence at the preliminary meeting (personal or represented by a proxy).
2. Regular students of the Master's Programme in Microbiology are to be given priority.
3. Date of fulfilment of the necessary admission requirement(s); students who fulfilled the admission requirement(s) at an earlier time are to be given priority
4. Number of semesters the student has been enrolled for the Master's Programme in Microbiology; students who have been enrolled for a longer time are to be given priority
5. By lot.

§ 6 Mandatory and elective modules

- (1) Students have to complete mandatory modules equalling a total of 40 ECTS credits (three modules with 7.5 ECTS credits and one module each with 15 and 2.5 ECTS credits) and elective modules equalling a total of 52.5 ECTS credits (seven modules with 7.5 ECTS credits each), which is a total of 92.5 ECTS credits.
- (2) According to the treated content, modules are divided into the following fields: "General Microbiology", "Systematics", "Applied Microbiology", "Ecology of Microorganisms", and "Molecular Microbiology".

(3) The following **mandatory modules** must be completed:

| | |
|--|-------------------|
| Mandatory module 1: General Microbiology | 7.5 ECTS credits |
| Mandatory module 2: Systematics | 7.5 ECTS credits |
| Mandatory module 3: Applied Microbiology | 7.5 ECTS credits |
| Mandatory module 2: Instruction to Scientific Work | 15.0 ECTS credits |
| Mandatory module 3: Master's Thesis Defence (Defensio) | 2.5 ECTS credits |

Required total **40.0 ECTS credits**

(4) Students have to complete a total of seven **elective modules** which can be chosen freely from the following list.

| | |
|--|------------------|
| Elective module 1: General Microbiology – Bacterial Physiology | 7.5 ECTS credits |
| Elective module 2: General Microbiology – Fungal Physiology | 7.5 ECTS credits |
| Elective module 3: General Microbiology – Genetics | 7.5 ECTS credits |
| Elective module 4: General Microbiology – Selected Topics | 7.5 ECTS credits |

| | |
|--|------------------|
| Elective module 5: Systematics – Diversity and Phylogeny | 7.5 ECTS credits |
| Elective module 6: Systematics – Applied Systematics | 7.5 ECTS credits |
| Elective module 7: Systematics – Anamorphic Fungi | 7.5 ECTS credits |

| | |
|--|------------------|
| Elective module 8: Applied Microbiology – Selected Topics | 7.5 ECTS credits |
| Elective module 9: Applied Microbiology – Bioprocess Engineering I | 7.5 ECTS credits |
| Elective module 10: Applied Microbiology – Bioprocess Engineering II | 7.5 ECTS credits |
| Elective module 11: Applied Microbiology – Biodegradation | 7.5 ECTS credits |
| Elective module 12: Applied Microbiology – Waste Management | 7.5 ECTS credits |
| Elective module 13: Applied Microbiology – Geomicrobiology | 7.5 ECTS credits |

| | |
|---|------------------|
| Elective module 14: Ecology of Microorganisms – Soil Microbiology | 7.5 ECTS credits |
| Elective module 15: Ecology of Microorganisms – Anaerobes | 7.5 ECTS credits |
| Elective module 16: Ecology of Microorganisms – Ectomycorrhizae and Biological Control | 7.5 ECTS credits |
| Elective module 17: Ecology of Microorganisms – Current Issues | 7.5 ECTS credits |

| | |
|---|------------------|
| Elective module 18: Molecular Microbiology – Selected Topics | 7.5 ECTS credits |
| Elective module 19: Molecular Microbiology – Fungal Metabolism | 7.5 ECTS credits |
| Elective module 20: Molecular Microbiology – Ecology of Microorganisms | 7.5 ECTS credits |

| | |
|---|-----------------------|
| Elective module 21: Philosophy of Science and Gender Research | 7.5 ECTS credits |
| Elective modules 22 and 23: Modules from other Master's Programmes of the Faculty of Biology | 7.5 ECTS credits each |

Required total **52.5 ECTS credits**

§ 7 Courses of the mandatory and elective modules and ECTS credits.

| 1. | Mandatory module: General Microbiology | Sem. hours | ECTS credits |
|--|---|------------|--------------|
| a. | VO Microbial Physiology Particularities of the primary and secondary metabolism of microorganisms will be discussed. Further, the biosynthesis of extracellular polysaccharides and microbial biotransformations as well as the preparation of “single cell protein” will be treated. | 2 | 3 |
| b. | VO Fungal Physiology This course treats the topics of growth in submerged culture, nutrient uptake, primary metabolism and stress tolerance of filamentous fungi. General basics as well as fungi-specific characteristics will be addressed. | 2 | 3 |
| c. | VO Genetics I (Microorganisms) Structure and changes of the genome, recombination, gene control – gene function, genetic systems | 1 | 1.5 |
| | Total | 5 | 7.5 |
| Learning objectives: Basics of bacterial and fungal physiology as well as basics of genetics of microorganisms | | | |
| Admission requirements: none | | | |

| 2. | Mandatory module: Systematics | Sem. hours | ECTS credits |
|--|---|------------|--------------|
| a. | VO Virology I Structure of viruses, brief introduction to the systematics of viruses, viral infections on a cellular and organismic level; virus/immune system interaction, antiviral therapy | 1 | 1.5 |
| b. | VO Systematics I (Bacteria, Archaea) Current taxonomic classification of bacteria and archaea and basics. | 1 | 1.5 |
| c. | VO Systematics II (Fungi) After an introduction into the basic principles of mycological systematics, different groups of fungi (including fungal-like organisms such as myxo- and oomycetes) will be presented according to their morphologic and physiological-biochemical (chemotaxonomic) properties and reproduction. | 2 | 3 |
| d. | VO Phylogenetical Systematics Phylogeny treats the evolution history of a species or a group of species with particular focus on lineages and relations between large groups of organisms. In this lecture, the most important methods for data collection and data analysis will be presented and discussed on the basis of recent research results. | 1 | 1.5 |
| | Total | 5 | 7.5 |
| Learning objectives: Current overview of the morphology and life of microorganisms and their phylogenetic relations; basics on the taxonomy and identification of microorganisms and viruses | | | |
| Admission requirements: none | | | |

| 3. | Mandatory module: Applied Microbiology | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Industrial Biotechnology Presentation on economic relevance, biotechnological production and application of technical and pharmaceutical products and procedures (e.g. organic acids, microbial polymers, alcohols, enzymes, immunosuppressive agents, human proteins) | 3 | 4.5 |
| b. | VO Molecular Biotechnology The lecture presents standard methods and special fields in molecular biotechnology (e.g. genomics, protein interactions, drug targeting, regulation and optimization of production strains) | 2 | 3 |
| | Total | 5 | 7.5 |
| | Learning objectives: Procedures for the production and application of biotechnical and pharmaceutical products as well as standard methods and main fields of application of molecular biotechnology | | |
| | Admission requirements: none | | |

| 4. | Mandatory module: Instruction to Scientific Work | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | PJ Instruction to Scientific Work Students are introduced to scientific methods for the design, realisation, interpretation and presentation of the Master's Thesis. | 10 | 15 |
| | Total | 10 | 15 |
| | Learning objectives: Ability to design, elaborate and assess complex trials in the frame of the Master's Thesis | | |
| | Admission requirements: none | | |

| 3. | Mandatory module: Master's Thesis Defence (Defensio) | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| | Oral defence of the Master's Thesis before an examination board. | | 2.5 |
| | Total | | 2.5 |
| | Learning objectives: Students are able to assess their Master's thesis in the overall context of the Master's Programme in Zoology. | | |
| | Admission requirements: positive completion of all other mandatory and elective modules and positive evaluation of the Master's Thesis | | |

| 1. | Elective module: General Microbiology – Bacterial Physiology | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | UE Physiology of Microorganisms – Laboratory Course Based on already acquired microbiological working methods, more complex microbiological trials on bacterial physiology (growth, infection by phages, diauxy, N ₂ fixing, metabolite production) will be made. | 4 | 6 |
| b. | SE Physiology of Microorganisms – Seminar The results from the course will be presented and discussed in depth by students in presentations. | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Planning, executing and evaluating complex trials on bacterial physiology | | |
| | Admission requirements: none | | |

| 2. | Elective module: General Microbiology – Fungal Physiology | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | SE Fungal Physiology – Seminar In order to deepen the knowledge from the lecture on Fungal Physiology and as a preparation for the course in Fungal Physiology, topics from the areas of growth, nutrient uptake, primary metabolism, secondary metabolism and stress tolerance of fungi will be treated. | 1 | 1.5 |
| b. | UE Fungal Physiology – Practical Course Based on changes in the rate of glucose uptake, the impact of different cultivation parameters on the metabolism of filamentous fungi in chemostat will be investigated. Special topics will be selected on the basis of current research work. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Important aspects of fungal physiology, such as growth, nutrient uptake and metabolism | | |
| | Admission requirements: successful completion of compulsory module 1 | | |

| 3. | Elective module: General Microbiology – Genetics | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Genetics II (Microorganisms) Molecular genetics of mating type changes in yeast, genetic manipulation in yeast: Yeast Two-hybrid, Cytotrap, artificial yeast chromosomes, “protein-protein arrays”, regulation of the cell cycle in yeast, Retransposon Ty, histone acetylation – DNA methylation, epigenetics in yeast (PSI+ phenotype) | 1 | 1.5 |
| b. | VU Genetics of Microorganisms - Laboratory Course Induction of the lac-operon will be investigated in the <i>Escherichia coli</i> model organism. A historical approach (original literature), simple methods and an extensive discussion of methods serve as an exemplary introduction to dealing with scientific problems. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: | | |

| | |
|--|---|
| | Deepened knowledge on the genetics of eukaryote microorganisms. |
| | Admission requirements: none |

| 4. | Elective module: General Microbiology – Selected Topics | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | VO Toxicology II Detailed discussion of microbial toxins. | 1 | 1.5 |
| b. | VO Immunobiology II The main functions of the immune system will be discussed in detail: immunity against microorganisms, deviation strategies of microorganisms, immunity against tumours – immunologic therapy approaches, rejection of tissue – transplantation immunology, autoimmune diseases, hypersensitivities – allergies, immune deficiencies. | 1 | 1.5 |
| c. | VO Mammalian Cell and Tissue Culture Basics and techniques in cell culture. | 1 | 1.5 |
| d. | SE Seminar on General Microbiology Topics for presentations will be selected from current issues in Microbiology. Each presentation will be discussed regarding formal issues and content. | 1 | 1.5 |
| e. | SE History of Microbiology – Seminar Presentations and discussions on the issues of discovery of microorganisms as useful organisms and pathogens as well as origin and development of microbiological resources and working methods. | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Basics and techniques in cell culture, knowledge on microbial toxins and main purposes of the immune system. Current and historical issues in Microbiology will be discussed in presentations. | | |
| | Admission requirements: none | | |

| 5. | Elective module: Systematics – Diversity and Phylogeny | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO – Fungal Ecology Introduction into the importance of fungi in the ecosystem. Topics include life strategies of fungi, aquatic and anaerobe fungi, fungi in extreme habitats, endophytic fungi and fungi-animal interactions. | 1 | 1.5 |
| b. | UE Basic methods for the Identification of Bacteria and Fungi Students will be familiarised with methods for identifying bacteria, fungi and fungi-like protists. Students should be able to reliably identify the main groups of microorganisms and develop ideas for the identification of an organism. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Relevance of fungi in the ecosystem (symbionts, parasites, destruent) and their interaction with other organisms. The course conveys practical skills/methods for identifying bacteria and fungi (main groups) | | |
| | Admission requirements: successful completion of compulsory module 2 | | |

| 6. | Elective module: Systematics – Applied Systematics | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | EU Mycological Excursion The students will be introduced into the impressive biodiversity and ecology of macromycetes (about 7000 basidiomycete species in Europe). The course consists of an excursion and of a laboratory part. Basic techniques in taxonomy, fungal morphology and microscopy will be taught during the laboratory part. | 4 | 4.5 |
| b. | VO Fungi in Human Nutrition This lecture looks at fungi as classic and new food products as well as at their ingredients. Furthermore, medicinal aspects and potential adverse effects of ingredients in fungi (e.g. mycotoxins) will be discussed: edible and poisonous mushrooms, medicinal mushrooms, significance for alcoholic drinks. | 1 | 1.5 |
| c. | VO Pathogenic Fungi Fungi can cause diseases in various organisms. Fungal skin and nail infections are the most common fungal diseases in humans. In addition, other mycoses, such as aspergillosis, histoplasmosis or coccidioides are becoming more wide-spread. Alternatively, fungal diseases in plants will be discussed (phytopathogenous fungi). | 1 | 1.5 |
| | Total | 6 | 7.5 |
| | Learning objectives: Scientific collection of fungi (fruiting body of wild mushrooms and of plants infected by parasitic fungi) and their identification; significance of fungi (wild and cultivated mushrooms) for human nutrition and socioeconomic significance of phytopathogenous fungi | | |
| | Admission requirements: successful completion of compulsory module 2 | | |

| 7. | Elective module: Systematics – Anamorphic Fungi | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Anamorphic Fungi This lecture gives an overview of large groups of anamorphic fungi and of methods for their identification. Based on concrete examples from the treated area, their practical relevance will be discussed | 1 | 1.5 |
| b. | UE Anamorphic Fungi In this practical course, students will be familiarised with standard methods of cultivation and microscopy for the detection and identification of fungi in food. Alternatively, detection and identification of medically relevant fungi will be treated. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Theoretical basics and practical skills for the identification of anamorphic fungi (“mildews”) | | |
| | Admission requirements: successful completion of compulsory module 2 | | |

| 8. | Elective module: Applied Microbiology – Selected Topics | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | SE Seminar: Applied Microbiology Topics for this seminar will be chosen from different alternating areas of | 1 | 1.5 |

| | | | |
|-----------|---|----------|------------|
| | Microbiology (e.g. industrial microbiology, environmental biotechnology, food microbiology, medical microbiology). | | |
| b. | UE Applied Microbiology – Laboratory Course Based on biological parameters the impact of inorganic and organic pollutants on microbial activity will be investigated; further topics include the degradation of mineral oil hydrocarbons in soils and wastewater treatment. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Ability to present selected topics in Applied Microbiology and to perform laboratory experiments in these fields | | |
| | Admission requirements: none | | |

| | | | |
|-----------|---|-------------------|---------------------|
| 9. | Elective module: Applied Microbiology – Bioprocess Engineering I | Sem. hours | ECTS credits |
| a. | SE Bioprocess Technology – Seminar The necessary background knowledge for the course “Bioprocess Technology” will be acquired through various learning methods (presentations, group work, and discussions) in this seminar, and the results from the practical course will be interpreted and presented. | 1 | 1.5 |
| b. | UE Laboratory Course in Bioprocess Technology From the strain to the product: A microbial metabolite will be prepared in the laboratory reactor and the process will be observed analytically. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Ability to work out selected topics in bioprocess engineering in team work, and practical application of relevant industrial production procedures in the laboratory. | | |
| | Admission requirements: none | | |

| | | | |
|------------|--|-------------------|---------------------|
| 10. | Elective module: Applied Microbiology – Bioprocess Engineering II | Sem. hours | ECTS credits |
| a. | VO Bioprocess Technology Presentation of process-based principles for the industrial application of biocatalysts: requirements for biocatalysts, media optimisation, types and control of bioreactors, product recovery, sample processes. | 2 | 3 |
| b. | EX Applied Microbiology Excursions Complementary to the lecture on Bioprocess Engineering, excursions will be made to pharmaceutical-, food processing-, as well as waste- and waste water processing operators. | 4 | 4.5 |
| | Total | 6 | 7.5 |
| | Learning objectives: Basics in Bioprocess Engineering and familiarisation with practical applications in the course of excursions | | |
| | Admission requirements: none | | |

| 11. | Elective module: Applied Microbiology – Biodegradation | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Organic Wastes Occurrence, makeup and processing of organic wastes, as well as applications in agriculture and forestry | 2 | 3 |
| b. | UE Biodegradation Laboratory Course Trials on the biodegradation of natural substances. | 3 | 4.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Knowledge about occurrence, makeup and management and treatment of organic wastes, regional and global future scenarios and pros and cons of various treatment methods | | |
| | Admission requirements: none | | |

| 12. | Elective module: Applied Microbiology – Waste Management | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | VO Waste and Resource Management Resource flows in waste management, treatment technologies and landfilling, including environment-related aspects (release of pollutants) | 1 | 1.5 |
| b. | UE Biogas - Laboratory Course Application-oriented laboratory course in the context of biogas production using the demonstration facility. | 3 | 4.5 |
| c. | SE Biowaste Treatment Technologies – Seminar Discussion of papers related to biowaste treatment (composting, fermentation, transformation into humus) | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Knowledge on the manifold possibilities of recycling biowaste; different research questions on fermentation and fields of application of the fermentation products in agriculture will be treated | | |
| | Admission requirements: none | | |

| 13. | Elective module: Applied Microbiology – Geomicrobiology | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | SE Geomicrobiology - Seminar Alternative techniques for the extraction of metals from ores, minerals and products of chemical industries (fly ash, sludges, etc.) using microorganisms will be presented and discussed. | 1 | 1.5 |
| b. | UE Geomicrobiology Laboratory Course On the basis of a practical biohydrometallurgical procedure for leaching zinc from industrial intermediate products students will be familiarised with selected procedures for metal analysis and deepen their knowledge on microbiological working methods. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Biohydrometallurgical leaching procedures. In the laboratory course, students will be familiarised with alternative techniques for metal recycling from secondary raw materials | | |

| | |
|--|--|
| | (industrial waste) on the basis of copper and zinc leaching using fungi. |
| | Admission requirements: none |

| 14. | Elective module: Ecology of Microorganisms – Soil Microbiology | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | SE Soil Microbiology - Seminar In the framework of presentations, selected areas of soil microbiology and applied methods (classic microbiological, enzymatic and molecular biological methods) will be discussed. | 1 | 1.5 |
| b. | UE Soil Microbiology – Laboratory Course On the basis of current issues (e.g. sludge application) basic soil chemical and physical, microbiological and molecular biological parameters will be determined and critically evaluated with regard to their significance. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Students are familiarised with current issues of soil microbiology applying microbiological and molecular biological methods. | | |
| | Admission requirements: none | | |

| 15. | Elective module: Ecology of Microorganisms – Anaerobes | Sem. hours | ECTS credits |
|-----------|--|-------------------|---------------------|
| a. | VO Anaerobic Microorganisms This lecture provides background information about anaerobic microorganisms, their physiological properties and their crucial role in different habitats. Special detection-methods and particular culture techniques will be discussed. | 1 | 1.5 |
| b. | SE Anaerobic Microorganisms - Seminar Different physiological, ecological and methodological aspects concerning anaerobic microorganisms will be discussed. | 1 | 1.5 |
| c. | UE Anaerobic Microorganisms - Laboratory Course Handling of facultative and strictly anaerobic microorganisms. | 3 | 4.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Theory and practice on the microbiology of anaerobic organisms | | |
| | Admission requirements: none | | |

| 16. | Elective module: Ecology of Microorganisms – Ectomycorrhizae and Biological Control | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VU Monitoring of Ectomycorrhizae Practical and theoretical methods for quantitative and qualitative analysis of the ectomycorrhized fine root system of forest trees (in situ sampling, biomass of fine roots, frequency of ectomycorrhizae, morpho-anatomical characterisation of ECMs, statistical analysis and documentation). | 4 | 6 |
| b. | VO Biological Control Besides basics on biological control (biology and environmentally-friendly methods to combat pathogens), procedures and methods which are | 1 | 1.5 |

| | | | |
|--|--|----------|------------|
| | successfully applied in organic farming will be presented. | | |
| | Total | 5 | 7.5 |
| | Learning objectives: Theoretical basics and mainly practical methods in the morphoanatomic characterisation of ectomycorrhizae; basics on biological control (biology and environmentally-friendly control of pathogens) as well as procedures and methods applied in organic farming. | | |
| | Admission requirements: none | | |

| 17. | Elective module: Ecology of Microorganisms – Current Issues | Sem. hours | ECTS credits |
|------------|---|-------------------|---------------------|
| a. | VU Microbial Ecology On the basis of current research projects, methods of microbial ecology will be taught and applied. | 4 | 6.5 |
| b. | SE Techniques in Microbial Ecology – Seminar Literature seminar in which classical and new molecular methods will be presented and discussed. | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Knowledge on microbial communities and processes on the basis of current research issues. | | |
| | Admission requirements: none | | |

| 18. | Elective module: Molecular Microbiology – Selected Topics | Sem. hours | ECTS credits |
|------------|--|-------------------|---------------------|
| a. | VO Molecular Bacteriology Effects of antibiotics and resistance to antibiotics, bacterial promoters and regulation systems, molecular biological methods for the identification, differentiation and systematisation of bacteria. | 1 | 1.5 |
| b. | VO Molecular Mycology An overview of the most common facultative pathogenic fungi will be given. Particular focus will be put on molecular aspects of virulence factors, effects of antimycotics, development of resistance mechanisms and development of new antimycotics. The pathogenesis of fungal pathogens, immunologic aspects of the host and procedures for diagnosis will also be discussed. | 1 | 1.5 |
| c. | VO Molecular Biology of Infectious Diseases Microbial pathogenic factors (offensive, defensive, non-specific), microbial surface variations and pathogenicity, regulation of virulence-associated genes, microorganisms and cancer, prions, viroids. | 1 | 1.5 |
| d. | VO Virology II Virus diagnostics, replication cycle and interaction with the host cell metabolism of selected viruses, oncogenous viruses | 1 | 1.5 |
| e. | SE Molecular Microbiology - Seminar In-depth discussion of selected areas from the lectures | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Molecular processes specific for microorganisms (bacteria, fungi) and viruses, including knowledge on molecular causes for the pathogenicity of different microorganisms (The | | |

| | |
|--|--|
| | module combines Molecular Biology with new results from research on infectious diseases) |
| | Admission requirements: none |

| 19. | Elective module: Molecular Microbiology – Fungal Metabolism | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Molecular Microbiology Molecular biology of selected fungal metabolism pathways with a focus on regulation circles; methods for the genetic manipulation of fungi. | 1 | 1.5 |
| b. | UE Molecular Microbiology - Laboratory Course Characterisation of the regulation of fungal metabolism pathways (e.g. siderophore biosynthesis of <i>Aspergillus</i> spp.) by phenotypic characterisation of respective mutant strains, Northern-analyses of transcribed genes, PCR-analysis of the respective loci and biochemical analysis of metabolism products. | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Advanced working techniques applied in molecular microbiology including fungal research | | |
| | Admission requirements: none | | |

| 20. | Elective module: Molecular Microbiology – Ecology of Microorganisms | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Molecular Microbial Ecology Molecular methods of microbial ecology (e.g. fingerprinting methods such as PCR-DGGE, SSCP, ARDRA; cloning, real time PCR, microarrays) will be presented. | 1 | 1.5 |
| b. | UE Molecular Microbial Ecology – Laboratory Course Topics from the lecture will be treated in-depth on the basis of environmental samples (soils, sediments, composts, leaf surfaces, etc.). | 4 | 6 |
| | Total | 5 | 7.5 |
| | Learning objectives: Theory on molecular techniques in microbial ecology (e.g. PCR-DGGE, SSCP, ARDRA; cloning, microarrays, FISH) particularly for terrestrial ecosystems as well as application of these techniques, including advanced assessment procedures. | | |
| | Admission requirements: none | | |

| 21. | Elective module: Philosophy of Science and Gender Research | Sem. hours | ECTS credits |
|-----------|---|-------------------|---------------------|
| a. | VO Nature as a Political Subject Concept of and reference to nature in the context of science, culture and society. | 2 | 3 |
| b. | VO Philosophy of Science and Ethics Introduction to Science Theory and its relation to other scientific disciplines, Science Theory in Biology (particularly Evolution Biology) as well as basics in Scientific and Environmental Ethics under consideration of gender aspects. | 2 | 3 |

| | | | |
|-----------|---|----------|------------|
| c. | SE Philosophy of Science and Ethics In-depth discussion of selected problems treated in the lecture “Philosophy of Science and Ethics”. | 1 | 1.5 |
| | Total | 5 | 7.5 |
| | Learning objectives: Under consideration of gender aspects, students will acquire a basic knowledge of the science theory in biology, its relation to other scientific disciplines and its historical development, as well as a basic instrument of terms and concepts related to ethics, which will enable them to autonomously reflect on ethical questions related to science and the application of their knowledge in biology. | | |
| | Admission requirements: none | | |

| 22. 23. | Elective module: Modules from other Master's Programmes of the Faculty of Biology | Sem. hours | ECTS credits |
|--------------------|---|-------------------|---------------------|
| | A maximum of two modules (7.5 ECTS credits each) from the Master's Programmes in "Botany", "Ecology and Biodiversity" or "Molecular Cell and Developmental Biology" at the University of Innsbruck can be selected. | | 7.5 each |
| | Total | | 15 |
| | Learning objectives: Students will acquire an insight into other areas of Biology according to the learning objectives defined for the respective module. | | |
| | Admission requirements: Students must meet the admission requirements defined in the respective curricula. | | |

§ 8 Master's Thesis

- (1) Students of the Master's Degree Programme in Microbiology have to write a Master's Thesis equalling 27.5 ECTS credits. The Master's Thesis is a scientific piece of work which serves to prove the student's ability to autonomously cope with scientific questions using adequate scientific methods.
- (2) The topic of the Master's Thesis must be related to one of the following fields: “General Microbiology”, “Systematics”, “Applied Microbiology”, “Ecology of Microorganisms”, or “Molecular Microbiology”.

§ 9 Examination regulations

- (1) A module is completed when the student has passed all the required courses.
- (2) For lectures, the lecturer is required to communicate evaluation methods and criteria (oral and/or written) before the course starts.
- (3) The evaluation of courses with continuous performance assessment (VU, UE, PS, SE, EX, EU, PJ) is based on the student's regular, written and/or oral and/or practical contributions. The lecturer is required to communicate evaluation methods and criteria before the course starts.
- (4) The evaluation of the student's final dissertation defence (Defensio) is based on an oral exam before an examination board which is made up of three examiners including the Master's Thesis supervisor.

§ 10 Academic degree

Graduates of the Master's Programme in Microbiology are awarded the academic degree of "Master of Science", or "MSc", in brief.

§ 11 Implementation

This curriculum comes into force on 1 October 2008.

§ 12 Transitional provisions

- (1) Regular students who enrolled in the "Magister" Programme in Microbiology (Curriculum of 7 July, 2003) at the University of Innsbruck before 1 October 2008 shall be entitled to complete their studies within a period of six semesters following the implementation of this curriculum.
- (2) Unless the student completes the "Magister" Programme in Microbiology (Curriculum of 7 July, 2003) within this period, he/she shall be subjected to the Curriculum for the Master's Degree Programme in Microbiology.
- (3) Students shall be entitled to choose to be subjected to the Curriculum for the Master's Degree Programme in Microbiology at any time.

For the Curriculum Committee:

Ao.Univ.Prof. Mag. Dr. Paul Illmer

For the Senate:

Univ.Prof. Dr. Ivo Hajnal