

Master 's Programme in Microbiology and Microbial Biotechnology, curriculum 2023-2026

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Note that changes may occur, please check the latest information from Sisu

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Master 's Programme in Microbiology and Microbial Biotechnology

MH80_007 Mikrobiologian ja mikrobioteekniikan maisteriohjelman

MH80_007 Magisterprogrammet i mikrobiologi och mikrobiell bioteknik

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	120 cr
Languages	English, Swedish, Finnish
Grading scale	Pass-Fail
Content approval required	no
Locations	Helsinki
University	University of Helsinki
Responsible organisation	Faculty of Agriculture and Forestry 100%
Responsible persons	Hanna Happonen, Administrative person Sari Timonen, Responsible teacher Nina Niemeläinen, Administrative person Tuula Hiltunen, Administrative person
Degree programme type	Master's Degree
Degree titles	Master of Science
Study field	Fields of education (Ministry of Education and Culture), Agriculture and forestry
Education classification	742702 MSc, Biosciences, Biochemistry

Content description

EN:

Profile

Why are microbes the most important group of organisms on our planet? How is knowledge of microbiology applied in medicine and industry, or in food production? What research techniques are used to study viruses, bacteria and other microbes? These are important questions, and you can find answers to these and many others in the study of Microbiology and Microbial Biotechnology.

Skills relevant to employment

Master's Programme's curriculum includes a course with themes integrating to Academic University Studies, career planning, and building expertise. These themes are covered in the MMB-101 Master's thesis seminar.

International skills

As a microbiology student, you will have good opportunities to participate in international student exchanges. You can complete some parts (e.g. practical training, Master's thesis, courses) of the degree at universities abroad. In addition, there are many international students and researchers at the Department of Microbiology and on the Viikki campus, bringing a global multicultural atmosphere to your everyday life.

Continuous learning

Persons not enrolled as undergraduate or postgraduate degree students at the University of Helsinki may be granted a right to complete non-degree studies. This right may be granted to enhance the applicant's professional or academic expertise or to incorporate the studies in question in a degree completed at another educational institution.

Supplementary studies (i.e., studies that supplement a degree completed at the University of Helsinki) also count as non-degree studies.

Read more about non-degree studies in the Faculty of agriculture and forestry.

Sustainability expertise

Master's programme enables the completion of the Sustainability course (SUST-001, 3 cr). MMB programme also enables to include a sustainability study module in the degree.

Criteria for full-time and part-time studies, opportunities for distance learning

Programme includes obligatory laboratory exercises and works which require attendance. Some courses can be completed through distance learning. Studies are planned to be completed in two years of full time studies.

Practices for collecting and processing student feedback

HowUlearn questionnaire 3 and academic year's feedback are conducted once during the first year of studies in spring term. During the second year or in the final phase of studies is collected academic year's feedback. Feedback is discussed at the steering board of the programme and with the students in co-operation with the student association. Course feedback is collected from all courses that provide teaching. Students have also possibility to give anonymous feedback with the separate Moodle feedback function.

General description of the structure

Structure of the degree in the Instructions for students pages.

Order and schedule of completion for studies

Students can utilize timing template in Sisu on the personal study plan's sheet Timing.

Learning outcomes

EN: Upon completing your degree, you will:

- Understand the global significance of microbes as remodelers and processors of life and the environment
- Understand the most important functions and molecular mechanisms of the major groups of microbes Understand the potential use of microbes in biotechnological applications, such as foodstuffs, drugs, and industrial processes
- Be able to evaluate the effects of changes in the environment on microbial communities and thus on the function of the biosphere
- Be able to assess the use of microbes in a variety of environments and situations
- Be able to evaluate ethical questions and the prerequisites of commercialization related to the use of microbes and biotechnology
- Be aware of the most important pathogens and their virulence mechanisms
- Master the most important microbiological and biotechnological research methods, and be proficient in the interpretation and evaluation of research results
- Have the capability to plan and lead activities in microbiology and biotechnology
- Be able to disseminate relevant information about your topic in an international environment

Additional information

EN:

Job descriptions and sectors of graduates

As a master of science graduating from the master's programme in Microbiology and microbial biotechnology you will be well prepared to (a) continue your studies toward a doctoral degree, (b) specialize as a hospital microbiologist, or (c) proceed directly to a career in working life. Statistically, the situation for microbiologists proceeding to employment has been very favourable.

As a microbiology graduate, you can work in the following sectors:

- Research and development (universities, research institutes, companies)
- Surveillance/monitoring in healthcare, food and environment (food industry, drug and diagnostics industry, regulatory authority)
- Administration, professional roles and consultancy (companies, ministries, supervision offices, EU) Business and management (companies, ministries, supervisory offices, EU)
- Teaching and education (universities, universities of applied sciences, vocational schools, high schools, comprehensive schools, organisations). Pedagogical study right can not be applied for during your Master's degree. However, you can apply for a study right after you have completed the Master's degree. Some students may already have the pedagogical study rights from their Bachelor study right.

Student selection

Read about the admissions from Studyinfo.

Bachelor's programmes with options to continue with certain criteria to MMB programme are University of Helsinki's Bachelor's programmes in Biology, Environmental Sciences, Food Sciences and Molecular Biosciences.

Postgraduate study options and opportunities

As a graduate of the Master's degree programme, you will be able to proceed to scientific postgraduate studies (i.e. doctoral degrees) in several fields of the biosciences, for example in Doctoral Programme of Microbiology and Biotechnology, Doctoral Programme in Food Chain and Health, Doctoral Programme in Interdisciplinary Environmental Sciences, and Doctoral Programme in Integrative Life Science.

Procedures for the recognition and validation of prior learning

General University of Helsinki guidelines on the recognition of prior learning.

Graduation practices and criteria

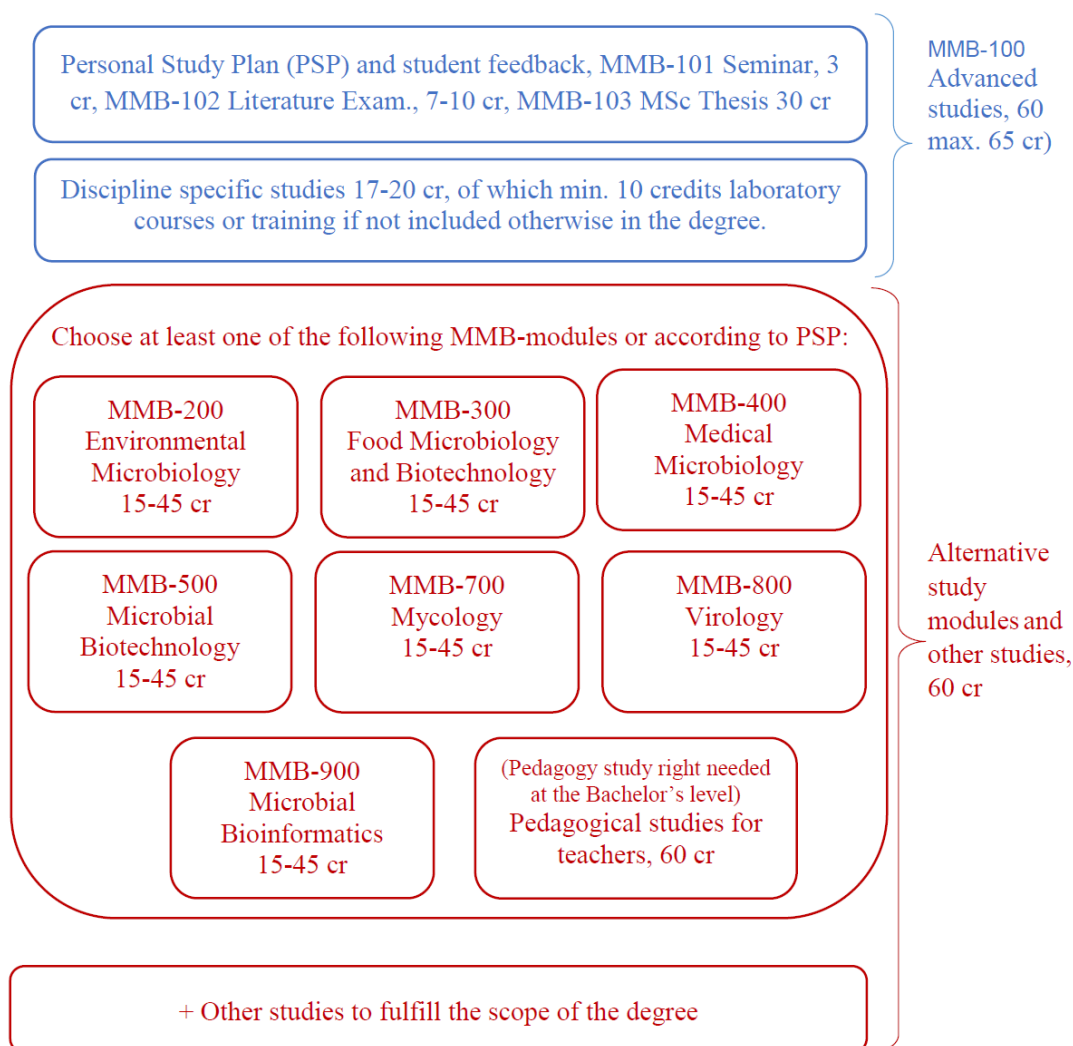
Faculty's graduation practices

Student supervision

PSP instructions for students

Faculty's guidance alignments

DEGREE STRUCTURE



Study modules

MMB-100 Microbiology and Microbial Biotechnology, Advanced Studies

MMB-100 Mikrobiologia ja mikrobibiotekniikka, syventävät opinnot

MMB-100 Mikrobiologi och mikrobiell bioteknologi, fördjupade studier

Abbreviation: Mikrobiologia j

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	60 cr
Languages	Finnish, Swedish, English
Graded module	yes
Grading scale	General scale, 0-5
Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Per Saris, Responsible teacher Hanna Happonen, Administrative person
Study module level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Learning outcomes

EN: After completing the module

- Students have profound understanding on the key elements and theory of microbiology. They have gained knowledge on microbial biology, systematics, evolution and metabolism.
- Students are able critically consider, plan and implement a research project in a timeframe and define appropriate research questions based on a theoretical framework. They can summarize their own MSc research, main results and conclusions to a broad audience. They can critically assess the research work of others and receive and use feedback in his/her own research and writing. They are able to apply ethical principles in science.
- Students are prepared for lifelong learning in the role of an expert in microbiology and microbial biotechnology.

Prerequisites

EN: Bachelor's degree

Additional information

EN:

Target groups

Compulsory for students in Microbiology and microbial biotechnology master's programme

Recommended time or stage of studies for completion

1st and 2nd year of MSc

Language of instruction

English, Finnish

MMB-200 Environmental Microbiology, Study Module

MMB-200 Ympäristömikrobiologia, opintokokonaisuus

MMB-200 Miljömikrobiologi, studiehelhet

Abbreviation: Ympäristömikrob

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	15-45 cr
Languages	Finnish, Swedish, English
Graded module	yes
Grading scale	General scale, 0-5
Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Hanna Happonen, Administrative person Taina Lundell, Responsible teacher
Study module level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences
Content description	

EN: Compulsory courses 10 cr

These courses or corresponding are compulsory if not included in the BSc degree:

MMB-201 Microbial ecology / Ympäristömikrobiologia luennot & seminaari 5 cr

Either MOLE-103 Diversity, structure and function of microbes (in Finnish) 5 cr

or ENV-201 ympäristömikrobiologia, or BIO-210, or MMB-105 book exam 5 cr

Optional courses 5 – 45 cr

MMB-108 Practical training and report 5 cr

MMB-110 Advanced environmental microbiology project in a research group 10 -12 cr

MMB-114 Exploratory microbial research, lab course 15 cr

MMB-117 Environmental microbiology - lab course* 5 cr

MMB-119 Microbial genetics - lab course 5 cr

MMB-502 Microbial biotechnology - lectures & seminar 5 cr

MMB-601 Fungi in sustainable biotechnology on renewable natural resources* 5 cr

MMB-701 Sienten biologia - luennot & seminaari* 5 cr

MMB-805 Viruses - lectures & seminar 5 cr

MAAT-021 Maaperätieteen perusteet 5 cr

MOLE-205 Mikrobit ja ihminen 5 cr

ENV-311 Akvaattisten tieteiden perusteet 5 cr

ENV-344 Ympäristökemia 5 cr

EOGS-011 Advanced aquatic and sediment biogeochemistry 5 cr

EOGS-014 Diagnosis of environmental problems in aquatic ecosystems 5 cr

EEB-201 Laboratory methods in molecular ecology 5 cr

FOR-271 Practical course in bioinformatics 5 cr

GMB-216 Practical course in genome bioinformatics 5 cr

TMED-915 Introduction to Bioinformatics 5 cr

Courses Taken at Other Universities 1-15 cr

VIIKM-200 Study Module Taken at Other University 15-45 cr

Other suitable courses according PSP

** Not arranged every year*

Learning outcomes

EN: A student who has completed the environmental microbiology module can describe the microbes and microbial groups relevant in diverse environments and ecosystems, and understands their functions and significance for humans and nature. Student knows the aspects of microbial diversity, ecology, physiology, genetics and biotechnology in the environments. With completion of the study module, student can apply this knowledge widely in environmental microbiology research and environmental monitoring.

Prerequisites

EN: Bachelor's degree

Additional information

EN:

Target groups

Optional. Microbiology and microbial biotechnology Master's program. Available to students from other study programs.

Recommended time or stage of studies for completion

1st and 2nd year of MSc studies.

Expiry of studies

10 years.

Language of instruction

English and Finnish.

Other information

A study plan must be negotiated and agreed with the coordinating teacher of the environmental microbiology module.

MMB-300 Food Microbiology and Food Biotechnology, Study Module

MMB-300 Elintarvikemikrobiologia ja -biotekniikka, opintokokonaisuus

MMB-300 Livsmedelsmikrobiologi och -bioteknik, studiehelhet

Abbreviation: Elintarvikemikr

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	15-45 cr
Languages	Finnish, English, Swedish
Graded module	yes
Grading scale	General scale, 0-5
Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Per Saris, Responsible teacher Hanna Happonen, Administrative person
Study module level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN:

Compulsory courses

These courses or corresponding are compulsory if not included into BSc degree:

MMB-301 Food microbiology* 5 cr

MMB-302 Food and environmental hygiene and control 5 cr

MOLE-103 Diversity, structure and function of microbes (in Finnish) 5 cr

or MMB-105 Brock literature examination 5 cr

* Note that ET-231 and MMB-301 are corresponding courses. If you have accomplished ETK-231, it's not possible to earn credits from MMB-301.

Optional courses

MMB-108 Practical training and report 5 cr

MMB-111 Advanced food microbiology project in a research group 10 -12 cr

MMB-114 Exploratory microbial research - lab course 15 cr

MMB-119 Microbial genetics - lab course 5 cr

MMB-303 Food Microbiology – lab course 5 cr

MMB-502 Microbial biotechnology - lectures & seminar 5 cr

MMB-503 Production of recombinant proteins - lab course 5 cr

MMB-701 Sienten biologia - luennot & seminaari / Fungal biology, book exam 5 cr*

MMB-805 Viruses lectures 5 cr

MMB-901 Microbial metagenomics 5 cr

FOOD-401 European food safety 5 cr

FOOD-109 Food fermentation and enzyme technology 5 cr

FOOD-403 Food toxicology and risk assessment 5 cr

ETK-221 Mikrobiologian laboratoriotyöt - lab course 3 cr

MOLE-205 Mikrobit ja ihminen 5 cr

MOLE-105 Biotekniikka 3 cr

Courses Taken at Other Universities

VIIKM-200 Study Module Taken at Other University 15-45 cr

Studies in food sciences, bioinformatics and biotechnology can also be included.

Learning outcomes

EN: The student understands how and which microbes cause harm (pathogens and spoilers) in the food chain from field to fork and recognize how the harm can be minimized. The student gets also familiar with how microbes can be utilized in food and understands how societies control the food chain in order to ensure safe food for the consumers.

Prerequisites

EN: Basic courses in microbiology, biotechnology, chemistry, biochemistry, genetics, food science and technology.

Bachelor's degree in Food Science, Molecular Biosciences, Biology, Environmental Sciences or other relevant field.

Food and Environmental hygiene and control –course and Food microbiology –course or equivalent courses are compulsory.

Additional information

EN:

Target groups

Optional. Students of microbiology and microbial biotechnology are first accepted to courses with limited amount of attendants (laboratory courses).

Recommended time or stage of studies for completion

1st and 2nd year of MSc

Expiry of studies

Ten years.

Language of instruction

English, Finnish

MMB-400 Medical Microbiology, Study Module

MMB-400 Lääketieteellinen mikrobiologia, opintokokonaisuus

MMB-400 Medicinsk mikrobiologi, studiehelhet

Abbreviation: Lääketieteellin

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 15-45 cr

Languages Finnish, English, Swedish

Graded module yes

Grading scale General scale, 0-5

Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Hanna Happonen, Administrative person Sarah Butcher, Responsible teacher
Study module level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN:

Contents

Contact teaching and supervision in laboratory, lectures, seminar work, bioinformatics exercises, pair or group work and writing of project reports. Optional studies also include research group practices.

Compulsory courses 15 cr

MMB-401 Seminar in evolution of microbial pathogenesis 5 cr

MMB-403 Seminar in molecular microbiology 5 cr

MMB-406 Bacteria-host interactions - laboratory course 5 cr

Optional courses 0-30 cr

MMB-107 Advanced bacteriology project in a research group 10 -12 cr

MMB-108 Practical training and report 5 cr

MMB-113 Advanced virology project in a research group 10 -12 cr

MMB-119 Microbial genetics - lab course 5 cr

MMB-404 Innate immunity -laboratory course 5 cr*

MMB-405 Clinical microbiology - laboratory course (in Finnish) 5 cr*

MMB-504 Microbial Genetics and Bioinformatics- lecture course 5 cr

MMB-805 Viruses - lectures 5 cr

MMB-803 Virological tools - lab course 5 cr

FOR-271 Practical course in bioinformatics 5 cr

GMB-105 Introduction to structural biology and biophysics 5 cr

GMB-216 Practical course in genome bioinformatics 5 cr

MBDP-302 Microbiology seminars 1-3 cr

TMED-915 Introduction to Bioinformatics 5 cr

MOLE-205 Mikrobiot ja ihmisen 5 cr

MOLE-704 Immunobiology/Immunobiologi 5 cr (former MOLE-701, 2 cr)

MOLE-801 Bakteriologian ja virologian harjoitustyöt 5 cr

PROV-407 Advanced immunobiology - lectures 5 cr

or other courses agreed in the personal study plan (PSP)

* Will be organized every second year

Learning outcomes

EN: The student can demonstrate advanced knowledge of medical microbiology. He/she recognizes the diversity of medically important microbes, their global significance and evolution. The student can describe structural and functional properties of main medically important microbes and knows the principles of current microbial classification. The student can describe main bacterial virulence mechanisms, knows about adaptive and innate host defense mechanisms and principles of antimicrobial strategies. Students can give details about microbe-host cell interactions and discuss about the epidemiology, transmission, and pathogenesis of microbes. The student understands the theory behind key methods applied in cellular microbiology and analysis of microbial virulence and knows how to apply the theoretical knowledge in practice. The student learns how to use bioinformatics in molecular and cellular microbiology research. Students are able to critically evaluate public information about medically significant microbes and they recognize the potential of microbes in medicine. After completion of the module students are able to critically read scientific literature and apply obtained information in reporting and presenting projects of their own. Students are capable of working in groups and teams, and they have skills for lifelong professional development in the role of an expert.

Prerequisites

EN: Basic knowledge on molecular and cell biology. Expertise in basic microbiology and molecular biology techniques. Basic laboratory skills. Bachelor's degree in Molecular Biosciences, Biology, Environmental Sciences or other relevant field

Additional information

EN:

Completion methods

Contact teaching and supervision in laboratory, lectures, seminar work, bioinformatics exercises, pair or group work and writing of project reports. Optional studies also include research group practices

Assessment practices and criteria

The grade of the module will be based on the grades of the individual courses included in the module. Target groups

The module belongs to the Master's Programme in Microbiology and Microbial Biotechnology and it is optional for the students in this programme. Advanced students from other programmes may also take the module if there is space in the compulsory laboratory course.

Recommended time or stage of studies for completion 1st and 2nd year of MSc studies

Expiry of studies
10 years

Language of instruction
English and Finnish

MMB-500 Microbial Biotechnology, Study Module

MMB-500 Mikrobibiotekniikka, opintokokonaisuus

MMB-500 Mikrobiell bioteknologi, studiehelhet

Abbreviation: Mikrobibiotekni

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	15-45 cr
Languages	Finnish, English, Swedish
Graded module	yes
Grading scale	General scale, 0-5
Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Kristiina Hilden, Responsible teacher Hanna Happonen, Administrative person
Study module level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN:

Contents

These courses or corresponding are compulsory if not included into BSc degree: 15 cr

MMB-502 Microbial biotechnology -lectures & seminar 5 cr

A course covering commercialization, innovations, marketing, patenting or entrepreneurship. Please consult Pauliina Lankinen before you enroll to the course of your choice.

Some choices to the biotechnology module:

ENT-202 Minustako muutoksentehtävä? 2 cr (in Finnish)

EKM-103 Managing innovation in agri-food value chains for sustainability. 5 cr

HELSEED programme and workshops. The credits vary depending of the units taken:

<https://www.thinkcompany.fi/what-we-do/programs/helseed-workshops>

<https://studies.helsinki.fi/courses/cur/otm-c354f4c2-6923-4e74-8a1e-35ef7f091e6f>

At least one of the following courses:

MMB-118 Metabolic engineering - lab course* 5 cr

MMB-503 Production of recombinant proteins - lab course* 5 cr

0-30 cr of these or other courses according to personal study plan

MMB-108 Practical training and report 5 cr

MMB-109 Advanced biotechnology project in a research group 10 -12 cr

MMB-114 Exploratory microbial research - lab course 15 cr

MMB-117 Environmental microbiology - lab course* 5 cr

MMB-118 Metabolic engineering - lab course* 5 cr

MMB-119 Microbial genetics - lab course 5 cr

MMB-503 Production of recombinant proteins - lab course* 5 cr

MMB-504 Microbial genetics and bioinformatics, lecture course 5 cr

MMB-505 Principles of RNA Biology 5 cr

MMB-803 Methods in virology 5 cr

MMB-901 Microbial metagenomics 5cr

FOOD-109 Food fermentation and enzyme technology 5 cr

FOR-271 Practical course in bioinformatics 5 cr

GMB-216 Practical course in genome bioinformatics 5 cr

TMED-915 Introduction to Bioinformatics 5 cr

SUST-001 Sustainability course 3 cr

MBDP-302 Microbiology seminar 1-3 cr

MBDP-303 Other relevant scientific seminars 1-3 cr

Courses Taken at Other Universities

VIIKM-200 Study Module Taken at Other University 15-45 cr

* Not arranged every year

Learning outcomes

EN: A student passing this module will be able to

- Critically evaluate the role of micro-organisms and microbial products in biotechnological processes Use and understand original research literature on a selected area of biotechnology
- Judge the relative support for different perspectives in potentially controversial issues based on a critical and objective analysis of published research
- Communicate complex scientific principles and ideas effectively
- Understand the commercial aspects of biological sciences

Prerequisites

EN: Basic knowledge on molecular and cell biology. Expertise in basic microbiology and molecular biology techniques. Basic laboratory skills. Bachelor's degree in Molecular Biosciences, Biology, Environmental Sciences or other relevant field.

Additional information

EN:

Target groups

Optional module in MSc program for Microbiology and Microbial Biotechnology. Available to students from other programs.

Recommended time or stage of studies for completion

1st and 2nd year of MSc, some courses can be taken during Bachelors degree.

Expiry of studies

10 years

Language of instruction

English

Assessment practices and criteria

Weighted mean of the grades of the courses

MMB-600 Microbiology, Study Module

MMB-600 Mikrobiologia, opintokokonaisuus

MMB-600 Mikrobiologi, studiehelhet

Abbreviation: Mikrobiologia,

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 15-45 cr

Languages Finnish, Swedish, English

Graded module yes

Grading scale General scale, 0-5

Content approval required no

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Hanna Happonen, Administrative person
Sari Timonen, Responsible teacher

Study module level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN: Compulsory courses

Either MOLE-103 Diversity, structure and function of microbes

or MMB-105 Biology of Micro-organisms book exam for MSc studies

MMB-201 Microbial ecology

Optional courses

MMB-108 Practical training and report

MMB-118 Metabolic engineering - lab course

MMB-701 Sienten biologia - luennot & seminaari / Fungal biology, book exam

MMB-805 Viruses

ETK-221 Mikrobiologian laboratoriotyöt

MOLE-205 Mikrobiit ja ihminen

Courses Taken at Other Universities

or other courses agreed with the responsible teacher of the module

Learning outcomes

EN: A student who has completed the microbiology study module will have present-day knowledge on microbial diversity in various environments, on the importance of microbes for ecosystems, human health and global welfare, and more specific understanding on the biology, genetics and functions of different microbial groups and viruses.

Prerequisites

EN: Studies in biochemistry, molecular biology and environmental sciences are recommended.

Additional information

EN:

Target group

Available for both Bachelor's and Master's students from other study programmes than MMB

Timing

Any time

Assessment practices and criteria

The grade of the module will be based on the grades of the individual courses included in the module.

Language of instructions

Finnish, Swedish, English

MMB-700 Mycology, Study Module

MMB-700 Mykologia, opintokokonaisuus

MMB-700 Mykologi, studiehelhet

Abbreviation: Mycology

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 15-45 cr

Languages Finnish, English, Swedish

Graded module yes

Grading scale General scale, 0-5

Content approval required no

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Hanna Happonen, Administrative person
Sari Timonen, Responsible teacher

Study module level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN: Mycology

Learning outcomes

EN: A student who has completed the mycology module can name the central fungal taxa and knows what characterizes them. She/he can identify these groups by morphological characteristics and knows the fundamentals of their ecology, physiology, genetics and biotechnology. She/he can also apply this knowledge widely on her/his chosen field of expertise. In order to focus the mycology module a study plan must be negotiated and agreed with the coordinating teacher of the module. The depth and width of learning increases according to the study points gained.

Additional information

EN:

Completion methods

See content description

Assessment practices and criteria

Weighted mean of the grades of the courses

Activities and methods in support of learning

According to courses taken

Target groups

Students of Microbiology and microbial biotechnology master's program. Students of other Master's programs as well as Bachelor's programs

Teaching period when the course will be offered

According to PSP

Recommended time or stage of studies for completion

Any time

Study module

Expiry of studies

Language of instruction

English, some studies can be done in Finnish

MMB-800 Virology, Study Module

MMB-800 Virologia, opintokokonaisuus

MMB-800 Virologi, studiehelhet

Abbreviation: Virologia, opin

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 15-45 cr

Languages Finnish, English, Swedish

Graded module yes

Grading scale General scale, 0-5

Content approval required no

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Minna Poranen, Responsible teacher
Hanna Happonen, Administrative person

Study module level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN:

Compulsory courses 5 cr

MMB-805 Viruses – lectures 5 cr

Optional courses 10-40 cr

MMB-803 Virological tools - lab course 5 cr

MMB-113 Advanced virology project in a research group 10 -12 cr

MMB-108 Practical training and report 5 cr

AGRI-253 Plant virology - includes laboratory work* 5 cr

DPBM-144 Molecular virology* 4 cr

DPBM-217 Clinical and Applied Virology 2 cr

MED-828 Lääketieteellinen mikrobiologia ja mikrobilääkkeet (muut kuin LTDK-opiskelijat) 5 cr

TMED-503 Infection Biology* 5 cr

ELL-454 Zoonoses in Europe* 2 cr

FOR-271 Practical course in bioinformatics 5 cr

GMB-105 Introduction to structural biology and biophysics 5 cr

GMB-216 Practical course in genome bioinformatics 5 cr

MBDP-301 Virus club 1-3 cr

TMED-915 Introduction to Bioinformatics 5 cr

ELK-121 Virologia 3 cr

FARM-310 Biologiset lääkevalmisteet II, peruskurssi ** 5 cr

MOLE-704 Immunobiology 5 cr

MOLE-801 Bakteriologian ja virologian harjoitustyöt – lab course 5 cr

Courses Taken at Other Universities 1-15 cr

VIIKM-200 Study Module Taken at Other University 15-45 cr

or other suitable studies based on the personal study plan (PSP)

* Will be organized in every two or three years

** Requires right to study Pharmacy as a minor subject from the selection committee of the Faculty of Pharmacy.

Learning outcomes

EN: After completing this module, student will be able to:

- Assess the significance of viruses in different biological and environmental systems as well as in the society (human, animal and plant health).
- Describe structural and functional properties of different types of viruses
- Explain the current options for treatment and prevention of viral infections
- Predict viral functions based on their biochemical and structural properties
- Evaluate scientific reports and public information about viruses, and apply such information in reporting/presenting projects on viruses.
- Work in teams and be prepared for lifelong professional development as an expert

Depending on the choice of courses by the student, she/he will be able to:

- Propagate viruses and study viral infection cycles and structures
- Master different types of virological research methods
- Apply viruses as research and biotechnological tool

Prerequisites

EN: Basic knowledge on molecular and cell biology. Expertise in basic microbiology and molecular biology techniques. Basic laboratory skills. Bachelor's degree in Molecular Biosciences, Biology, Environmental

Sciences or other relevant field is recommended.

Additional information

EN:

Completion methods

Contact teaching and supervision in laboratory, lectures, workshop(s), pair or group work and/or writing of project reports.

Assessment practices and criteria

The grade of the module will be based on the grades of the individual courses included in the module Target groups

The module belongs to the Master's Programme in Microbiology and Microbial Biotechnology, but is optional for the students in this programme. It is also open for students from other programmes. The virology module is part of the university wide virology education involving five different Faculties.

Teaching period when the course will be offered

Teaching will be organized in period I-IV. MMB-113 course can also be arranged during summer.

Recommended time or stage of studies for completion

1st and 2nd year of MSc studies

Expiry of studies

Language of instruction

Depending on the course, English, Swedish and/or Finnish may be used in exams and reports.

MMB-900 Microbial bioinformatics, study module

MMB-900 Mikrobibioinformatiikka, opintokokonaisuus

MMB-900 Mikrobiell bioinformatik, studiehelhet

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	15-45 cr
Languages	English, Swedish, Finnish
Graded module	yes
Grading scale	General scale, 0-5
Content approval required	no
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Hanna Happonen, Administrative person Marko Virta, Responsible teacher
Study module level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Content description

EN: The study module contains three obligatory courses which are relevant for everyone studying microbes by using bioinformatics. Optional courses allow students to deepen their knowledge on the field of microbial bioinformatics based on their own interests.

Learning outcomes

EN: A student who has completed the Microbial bioinformatics module understands the basic concept and theory of bioinformatics. She/he can identify and use the most important bioinformatic tools and programmes used in microbiology. She/he can also apply this knowledge widely on her/his chosen field of expertise in microbiological research.

Prerequisites

EN: Bachelor's degree

Additional information

EN:

Target groups

Optional module in MSc program for Microbiology and Microbial Biotechnology.

Recommended time or stage of studies for completion

1st and 2nd year of MSc, some courses can be taken during Bachelors degree.

Expiry of studies

10 years

Language of instruction

English

Courses

MMB-101 MSc thesis seminar in microbiology and microbial biotechnology

MMB-101 MSc thesis seminar in microbiology and microbial biotechnology

MMB-101 MSc thesis seminar in microbiology and microbial biotechnology

Abbreviation: MSc thesis semi

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	3 cr
Languages	English, Finnish, Swedish
Grading scale	Pass-Fail
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Ville-Petri Friman, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Participation in the course requires that the student is ready to start the MSc thesis project. Ideally, the student will have started his/her MSc thesis project at the latest by the start of Period III, and the thesis supervisor has been identified in Period II.

Those who start only in period IV will complete the course in period I-II of the following year.

The thesis plan must be submitted to the head of the MMB programme for approval as soon as the supervisor is chosen and the planning seminar scheduled.

Recommended prerequisite LIB-200 "Information seeking and management for thesis writers."

Recommended prerequisites

LIB-200 Information Seeking and Management for Thesis Writers

Learning outcomes

EN: Students can critically consider the planning of a research project, they can summarize their scientific aims, principle methods, main results and conclusions to a broad audience, and consider how improvements to their presented work can affect the final written MSc thesis. They can critically assess the re- search

work of others. Students are prepared for lifelong learning in the role of an expert in microbiology and microbial biotechnology.

Content

EN: 7 minute presentation of the project plan includes the main scientific question, main approaches, time line. Students present the plan in Period I or II, as soon as the supervisor has been agreed. Supervisors are expected to be present when the plan is presented. Remote participation will be possible. Period III-IV students will write an abstract and include one key review article. Each student will give a 20 minute presentation of their results. Supervisors can be present. The presentation will be recorded for self-reflection. Each student will chair another presentation and given written feedback to all other students during the session. Each student writes an outline of the thesis ("contents page") including 10 key references. Each student writes a reflective summary of feedback received including self-reflection. Students doing thesis work over the summer can present the plan in period III or IV and the results in period I or II.

Additional information

EN:

Completion methods

Seminar without compulsory attendance.

Participation in teaching seminars which can be face to face or by distance learning, written assignments, feedback to other students

Assessment practices and criteria

Evaluation of the student's performance is based on the compulsory abstract, presentations, submission of feedback to all other students, outline of the thesis, and reflective analysis of feedback received and own self-reflection. The grading is pass/fail for the entire course

Activities and methods in support of learning

Students discuss the preparation of their two talks and thesis outline with their MSc supervisor; these will aid the student in presenting an initial plan for the thesis and then a research talk based on the results of their MSc thesis experimental work. The student independently finds and reads relevant literature. The teacher facilitates discussion of each project after the presentation amongst the students and gives oral feedback to each presenter. All students and supervisors present give written feedback. The student self-evaluates his/her own presentation from a recording. The supervisor is expected to be present in the first seminar where the plan is briefly presented to the Programme. Supervisors can support the students by rehearsing the presentation with the student, and by attending both seminars, although attendance is not required in the second seminar.

Target groups

Compulsory in the Master's Programme in Microbiology and Microbial Biotechnology. Students of the MMB Programme

Teaching period when the course will be offered

Period I-IV

Recommended time or stage of studies for completion

Microbiology Master's final year

Study module

MMB-100

Expiry of studies

10 years

Language of instruction

English, Swedish and Finnish

EQF level

Master's / EQF level 7

Study materials

EN: Material relevant to the individual research project. 1 major review article identified for the planning

seminar and abstract, 10 relevant articles identified for the thesis outline.

MMB-102 Literature examination for MSc

MMB-102 Maisterin kirjatentti

MMB-102 Literature examination for MSc

Abbreviation: Maisterin kirja

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	7-10 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Sarah Butcher, Responsible teacher Marko Virta, Responsible teacher Per Saris, Responsible teacher Ville-Petri Friman, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Examination after completion of most of the Master's degree studies

Learning outcomes

EN: The student understands the key elements of microbiology. The student can explain and describe microbiology, systematics, evolution and metabolism. The student can define microbiological terms. The student can apply knowledge acquired earlier to his/her own specialization and can generalize scientific knowledge. The student is able to draw conclusions from the text.

Content

EN: The aim of the literature exam is to deepen the student's understanding on a field of microbiology selected according to his/her preferences.

Additional information

EN:

Completion methods

Written exam in Moodle and oral exam remotely or on site

Assessment practices and criteria

Written and oral exam. Scale 0-5.

Activities and methods in support of learning

The literature read is indicated when signing up for the exam. Sign up for the oral exam with the responsible professor after the written exam. The literature list is available in the Moodle area MMB Master's Programme info. Independent learning of the material. Material can be used during the exam.

Target groups

Students of the MMB programme.

Teaching period when the course will be offered

Any

Recommended time or stage of studies for completion

2nd year of MSc

Study module

Compulsory in MMB-100 Microbiology and Microbial Biotechnology, Advanced Studies

Expiry of studies

The course expires in 10 years

Language of instruction

English, Finnish, Swedish

EQF level

Master's / EQF level 7

Study materials

EN: The literature list is available in the Moodle area MMB Master's Programme info. The literature is agreed with the responsible professor in advance. The literature read is indicated when signing up for the exam.

MMB-103 Master's Thesis

MMB-103 Maisterintutkielma

MMB-103 Magisteravhandling

Abbreviation: Maisterintutkie

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 30 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Marko Virta, Responsible teacher
Sarah Butcher, Responsible teacher
Per Saris, Responsible teacher
Sari Timonen, Responsible teacher
Ville-Petri Friman, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: The student needs to have the necessary knowledge and skills for collecting the data (field/laboratory) and processing (statistics) them, and skills for scientific writing.

Compulsory prerequisites

LIB-200 Information Seeking and Management for Thesis Writers

Learning outcomes

EN: After completing the thesis process, the student will be able

- to plan and implement a research project in a timeframe
- to define appropriate research questions and base them with a theoretical framework to design and carry out experiments under supervision
- to analyse and interpret the research results
- to present the results of the research according to scientific standards
- to receive and use feedback in his/her own research and writing
- to apply ethical principles in science.

Content

EN: The Master's thesis is usually based on an experimental research project and critical contemplation of the results in the light of scientific literature on the topic. The thesis may also consist of a theoretical literature study. A Master's thesis project usually consists of four distinct phases

1. design and planning of the study
2. gathering the data (field work and/or laboratory work and/or mathematical modelling)
3. analysing the data (validation/quality control, statistical analysis, plotting)
4. interpreting and discussing the results in the light of existing literature.

Additional information

EN:

Completion methods

Approval and grading is based on the written Master's thesis.

MSc thesis includes a written research plan and experimental part that is carried out under supervision. Student will write the MSc thesis consisting of 20-30 pages. Typically, the work is carried out in a research project in which you have a clearly defined and an independent role, including experimental design, collection of data, and data interpretation. The total workload from designing the project (for 30 credits) to its completion is approximately 4.5 months (800 hrs or 20 weeks at 40 hrs/week).

For detailed information about the Master's thesis, see the Faculty's General Instructions for Master's Theses in Instructions for students.

Assessment practices and criteria

The MSc thesis will be graded on the scale according to the guidelines set by the University and the Faculty. Assessment matrix can be found from Instructions for students.

Activities and methods in support of learning

Target groups

The course is compulsory for the students in Master's Programme Microbiology and Microbial Biotechnology

Teaching period when the course will be offered

I-IV

Recommended time or stage of studies for completion

Mainly second year of MSc studies. Research plan periods 3-4 in first year MSc studies, or/and field or laboratory work or other gathering of data first study year's summer or during periods 1-2 of second study year; data processing and writing period 3 of second study year. The Master's thesis project must not be started before obtaining an approval for the Master's thesis plan. For further information, see the General Instructions for Master's Theses. Each MSc thesis must have at least one supervisor who is a principal investigator in either the Faculty of Agriculture and Forestry, or the Faculty of Biological and Environmental Sciences.

Study module

Advanced studies in MMB

Expiry of studies

10 years

Language of instruction

English, Finnish

Responsible persons

Thesis plans approved by head of the MMB programme (Sari Timonen)

Theses assigned for evaluation to one of the following:

Sarah Butcher (Medical Microbiology)

Ville Friman (Environmental Microbiology)

Per Saris (Food Microbiology)

Marko Virta (Biotechnology)

EQF level

Master's / EQF level 7

Study materials

EN: Mainly international, scientific papers depending on the topic of the Master's thesis.

MMB-105 Brock literature examination

MMB-105 Brock-kirjatentti mikrobiologian maisterintutkintoon

MMB-105 Brock-kirjatentti mikrobiologian maisterintutkintoon

Abbreviation: Brock-kirjatent

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Per Saris, Responsible teacher
Study level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic knowledge in chemistry and biochemistry.

Recommended optional studies

Courses in chemistry, biochemistry, genetics and biotechnology

Equivalences to other studies

52817 Final Examination in Microbiology

or

86471 Intermediate Level Examination (MIKRO450)

Learning outcomes

EN: The student understands the diversity of microbes, cell biology, evolution, physiology, growth and genetics. One aim is to learn to analyse the function of microbial cells as independent cell units and in interaction with organism communities. The student can evaluate the importance of microorganisms not forgetting the historical aspects of the influence of microbial knowledge of the evolution of societies.

Content

EN: Microbial metabolism, genetics, evolution, diversity, ecology, and in addition immunology and diseases caused by microbes and microbes in industry and research

Additional information

EN:

Completion methods

The course is a literature examination.

Assessment practices and criteria

Literature examination, evaluation according to scale 0-5.

Activities and methods in support of learning

Target groups

This course is optional and available for students from different options

Teaching period when the course will be offered

I-IV periods

Recommended time or stage of studies for completion

First year of the Master's studies

Study module

Expiry of studies

10 years

Language of instruction

English

Target group

This course is optional and available for students from different options

EQF level

Bachelor's / EQF level 6

Study materials

EN: Brock Biology of Microorganisms 15th Global Edition PDF Book by Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley and David A. Stahl. Pearson Education Ltd.

The part of the book included in the examination are chosen based on the student's earlier studies.

MMB-106 Teaching practice

MMB-106 Teaching practice

MMB-106 Undervisningsövning

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 1-10 cr

Languages English, Finnish, Swedish

Grading scale Pass-Fail

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Sari Timonen, Responsible teacher
Taina Lundell, Responsible teacher
Pauliina Lankinen, Responsible teacher
Kristiina Hilden, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc and other background studies suitable to carry out the particular teaching.

Learning outcomes

EN: After teaching others the student understands how the teaching curriculum transfers to practical teaching. She/he has a better understanding of the different sectors and administrative steps, which need to be completed in order to teach in an institute. After teaching the student has a deeper understanding about the particular subject area covered.

Content

EN: Contact teaching / design and substance for web based teaching / production of teaching materials / experimenting with different pedagogical methods

Additional information

EN:

Completion methods

Teaching activities

Assessment practices and criteria

Pass-fail

Activities and teaching methods in support of learning

Supervision, guidelines and practical help for teaching

Target group

Not specified

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

Not specified

Expiry of studies

10 years

Language of instruction

English, Finnish, Swedish

EQF level

Master's / EQF level 7

Study materials

EN: Optional: Biggs J, Tang C. 2011. Teaching for quality learning at university / Lindblom-Ylänne S, Nevgi A, Horppu R, Iivanainen A. 2007. Yliopisto- ja korkeakouluopettajan käsikirja.

MMB-107 Advanced bacteriology project in a research group

MMB-107 Advanced bacteriology project in a research group

MMB-107 Advanced bacteriology project in a research group

Abbreviation: Advanced bacteriology

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 10-12 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Benita Westerlund-Wikström, Responsible teacher

Study level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. Experience of laboratory work

Recommended prerequisites

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-403 Seminar in molecular microbiology

MMB-114 Exploratory microbial research, lab course

Equivalences to other studies

528030 Laboratory Practices in Bacteriology

or

528031 Advanced Laboratory Practices in Bacteriology

or

528032 Advanced Laboratory Practices in Bacteriology II

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team
- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can write a short report of the findings based on the results documented in the laboratory notebook
- has practical and theoretical skills in risk assessment for the work (e.g. GMO, pathogens, chemicals).

Content

EN:

- Corresponds to 270 h (10 ect) or 324 h (12 ect) of full-time work including writing of the final report. Project plan (max. 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
- Project is carried out with an agreed supervisor.
- A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted to the supervisor.
- May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages.

Additional information

EN:

Completion methods

Laboratory research.

Assessment practices and criteria

Assessment consists of the research plan (accepted), laboratory note book (30%), performance in the laboratory, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and teaching methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

The course is included as optional in Study module MMB-400.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-108 Practical training and report

MMB-108 Harjoittelu ja harjoittelukertomus

MMB-108 Practical training and report

Abbreviation: Harjoittelu ja

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	Finnish
Grading scale	Pass-Fail
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Taina Lundell, Responsible teacher Per Saris, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Bachelor's degree or corresponding studies in microbiology or biotechnology.

Recommended optional studies

Advanced projects in a research group 10 cr

Equivalences to other studies

86489 Practical training and report (MIKRO610)

or

52887 Practical Training (Laudatur)

Learning outcomes

EN: Student can work safely in a microbiological laboratory following acceptable techniques and relevant instructions of the laboratory. Student can write an explicit and reflective report on the practice according to the given instructions.

Content

EN: Traineeship or laboratory research of minimum three month's duration in a microbiological, clinical or biotechnological laboratory as a work practice. Before starting the practice, contact the responsible teacher(s) for acceptance of the position and working place. Writing the report of the practice according to given instructions.

Additional information

EN:

Completion methods

Laboratory practice or field work in microbiology or biotechnology, preferably working in a company, test laboratory, or research institute. Writing and submission of a report of the practice to the Moodle site according to given instructions.

Assessment practices and criteria

Instructions for completion and assessment practices are given at the course Moodle platform.

Activities and methods in support of learning

Target groups

Optional in Master's studies in microbiology and microbial biotechnology

Teaching period when the course will be offered

All study periods, preferably summertime.

Recommended time or stage of studies for completion

Master's study years 1-2.

Study module

Expiry of studies

10 years

Language of instruction

Finnish and English

EQF level

Master's / EQF level 7

Study materials

EN: Instructions at the workplace and course Moodle platform, work related literature and information.

MMB-109 Advanced biotechnology project in a research group

MMB-109 Advanced biotechnology project in a research group

MMB-109 Advanced biotechnology project in a research group

Abbreviation: Advanced biotec

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 10-12 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Kristiina Hilden, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. Experience of laboratory work

Recommended prerequisites

MMB-114 Exploratory microbial research, lab course

or

MMB-502 Microbial biotechnology - lectures & seminar

Equivalences to other studies

882576 Advanced Training in a Research Group (BIOT422)

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team
- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can write a short report of the findings based on the results documented in the laboratory notebook
- has practical and theoretical skills in risk assessment for the work (e.g. GMO, pathogens, chemicals).

Content

- EN: · Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
 - Project is carried out with an agreed supervisor.

Additional information

EN:

Completion methods

Laboratory research

Assessment practices and criteria

Assessment consists of the project plan (accepted), laboratory notebook (30%), performance in the laboratory, quality of research work (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and teaching methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional.

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

The course is included as optional in Study module Microbial Biotechnology (MMB-500)

Expiry of studies

Ten years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-110 Advanced environmental microbiology project in a research group

MMB-110 Advanced environmental microbiology project in a research group

MMB-110 Advanced environmental microbiology project in a research group

Abbreviation: Advanced enviro

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	10-12 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Taina Lundell, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. degree. Experience of laboratory or field work.

Equivalences to other studies

86493 Working in Research Group (MIKRO590)

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team
- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can analyse the obtained data using reliable methods and calculation
- can write a short report of the findings based on the results documented in the laboratory notebook
- has practical and theoretical skills in risk assessment for the work (e.g. sampling and sample treatment, GMO, pathogens, chemicals, analytical methods).

Content

EN:

- Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
- Project is carried out with an agreed supervisor.
- A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted to the supervisor.
- May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages

Additional information

EN:

Completion methods

Laboratory research

Assessment practices and criteria

Assessment consists of the research plan (accepted), laboratory note book (30%), performance in the lab-

oratory, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project.

Target groups

Optional

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

Expiry of studies

Ten years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-111 Advanced food microbiology project in a research group

MMB-111 Advanced food microbiology project in a research group

MMB-111 Advanced food microbiology project in a research group

Abbreviation: Advanced food m

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 10-12 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Per Saris, Responsible teacher

Study level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. Experience of laboratory work.

Equivalences to other studies

86493 Working in Research Group (MIKRO590)

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team

- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can write a short report of the findings based on the results documented in the laboratory notebook
- has practical and theoretical skills in risk assessment for the work (e.g. GMO, pathogens, chemicals).

Content

EN:

- Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
- Project is carried out with an agreed supervisor.
- A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted to the supervisor.
- May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages

Additional information

EN:

Completion methods

Laboratory research

Assessment practices and criteria

Assessment consists of the research plan (accepted), laboratory note book (30%), performance in the laboratory, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

-

Expiry of studies

Ten years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-112 Advanced mycology project in a research group

MMB-112 Advanced mycology project in a research group

MMB-112 Advanced mycology project in a research group

Abbreviation: Advanced mycolo

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	10-12 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Sari Timonen, Responsible teacher
Study level	

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. Experience of laboratory work.

Equivalences to other studies

86493 Working in Research Group (MIKRO590)

Learning outcomes

EN: Student is able to work in a research team. Student can write a research plan. Student can plan and carry out a project in a scientific, reliable fashion. Student can write a short report of the findings based on the results documented in the laboratory notebook. Student has practical and theoretical skills in risk assessment for the work (e.g. GMO, pathogens, chemicals).

Content

- EN: · Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
 - Project is carried out with an agreed supervisor.
 - A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted to the supervisor.
 - May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages

Additional information

EN:

Completion methods

Laboratory research

Assessment practices and criteria

Assessment consists of the research plan (accepted), laboratory note book (30%), performance in the laboratory, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and teaching methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

Not obligatory for any study module

Expiry of studies

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-113 Advanced virology project in a research group

MMB-113 Advanced virology project in a research group

MMB-113 Advanced virology project in a research group

Abbreviation: Advanced virolo

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 10-12 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Minna Poranen, Responsible teacher

Study level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc. Experience of laboratory work.

Recommended prerequisites

MMB-801 Viruses - lectures

or

MMB-805 Viruses lectures

Equivalences to other studies

528040 Laboratory Practices in Virology

or

528041 Advanced Laboratory Practices in Virology I

or

528042 Advanced Laboratory Practices in Virology II

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team
- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can write a short report of the findings based on the results documented in the laboratory notebook
- has practical and theoretical skills in risk assessment for the work (e.g. GMO, pathogens, chemicals).

Content

EN:

- Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
- Project is carried out with an agreed supervisor.
- A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted to the supervisor.
- May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages

Additional information

EN:

Completion methods

Laboratory research

Assessment practices and criteria

Assessment consists of the research plan (accepted), laboratory note book (30%), performance in the laboratory, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

Expiry of studies

Ten years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, risk assessments.

MMB-114 Exploratory microbial research, lab course

MMB-114 Exploratory microbial research, lab course

MMB-114 Undersökande kurs i mikrobiologisk forskning

Abbreviation: Exploratory lab

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	15 cr
Languages	English, Swedish, Finnish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Taina Lundell, Responsible teacher Sari Timonen, Responsible teacher
Study level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Bachelor's degree, basics in microbiology and laboratory work, basics in biochemistry and molecular biology.

Equivalences to other studies

864085 Advanced Methods in Microbiology (MIKRO510)

Learning outcomes

EN: The student will be able to plan and implement experimental research in microbiology using essential phenotyping and genotyping methods and laboratory techniques. The student understands quality, risk assessment and acceptable methods in microbiology. The student is more experienced in team work, peer-review, assessment of own research, and in research presentation.

Content

EN: Isolation and characterization of microbes from selected samples and environments. Phenotyping and genotyping of bacteria using essential methods and data analyses. Project planning. Research-orientated individual and team work in a microbiological laboratory. Risk assessment, good laboratory practice and quality in the laboratory. Written assignments, weekly reports, poster design, oral presentations, lectures and workshops.

Additional information

EN:

Completion methods

Laboratory course in teams and group, lectures and workshops, individual work, weekly written assignments, final report, poster and oral presentations.

Assessment practices and criteria

Final report, course performance and team work, poster design and presentation. Grading according to scale 0-5/5.

Activities and methods in support of learning

Moodle web course, weekly written assignments and reports, laboratory notebook, team work, expert consultations and lectures, data analysis and poster sessions, peer-review, feedback discussions.

Target groups

Students of Microbiology and microbial biotechnology Master's program

Teaching period when the course will be offered

Study periods I-II

Recommended time or stage of studies for completion

Master's study year 1.

Study module

According to PSP

Expiry of studies

10 years

Language of instruction

English

EQF level

Bachelor's / EQF level 6

Study materials

EN: Madigan et al., 2015, Brock Biology of Microorganisms, 14th ed.; scientific articles and method protocols.

MMB-117 Environmental microbiology - lab course

MMB-117 Environmental microbiology - lab course

MMB-117 Environmental microbiology - lab course

Abbreviation: Environmental m

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Pauliina Lankinen, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: BSc with laboratory skills in microbiology and molecular biology

Recommended prerequisites

MMB-201 Microbial ecology

Equivalences to other studies

864107 Environmental microbiology, a laboratory course MIKRO542

Learning outcomes

EN: After the course student knows

- how to use traditional and modern methods to study microbes in environments
how to apply research on microbial ecology questions
- how to analyze and report results
- has improved understanding of the roles of microbes in specific ecosystems

Content

EN: Laboratory research, field sampling, analysis on microbial diversity and functions in environments, data analysis by using bioinformatics and statistics.

Additional information

EN:

Completion methods

Assessment practices and criteria

Submitted reports, oral presentation, laboratory notebook, course and laboratory performance. Evaluation according to scale 0-5.

Activities and methods in support of learning

Seminar day, peer-review and assessment, feedback session, written assignments.

Target groups

Optional course in environmental microbiology module and bioinformatics module.

Teaching period when the course will be offered

Study period III. Every second year, odd years

Recommended time or stage of studies for completion

1st or 2nd year of MSc

Study module

Optional course in environmental microbiology module and bioinformatics module.

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Instructions and literature given at the course, laboratory manuals, scientific articles.

MMB-118 Metabolic engineering - lab course

MMB-118 Metabolic engineering - lab course

MMB-118 Metabolic engineering - lab course

Abbreviation: Metabolic engin

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Tero Ahola, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic laboratory skills achieved during practical courses in bachelor level studies. Basic understanding of

biochemistry and microbiology achieved during bachelor level studies. Lecture course in metabolism is highly recommended as a preceding course.

Equivalences to other studies

85069 Metabolic engineering lab course BKEM201

Learning outcomes

EN: The student will learn to plan and evaluate experimental set-ups, as the whole course is conceived as an experiment, where the yeast growth conditions will first be selected, then the experiment performed and finally the results compared. The student will learn the basic principles of the use of yeast as a versatile experimental organism, as well as yeast genetics. The student will understand the basic ideas in metabolic engineering.

Content

EN: We will grow metabolically modified yeast strains and analyze cell growth as well as the production of some basic and derived (engineered) metabolites. Yeast transformation and basic concepts of yeast genetics as well as the use of auxotrophic selection markers will be included.

Additional information

EN:

Completion methods

The course consists of three weeks of laboratory work, and will additionally include a prior planning session and a later, concluding feedback session. The students will write a report during/after the course.

Assessment practices and criteria

Evaluated on the scale 0–5. Evaluation is based on the report written by the student.

Activities and methods in support of learning

The teacher will introduce the concepts and methods used through short lectures and demonstrations. Supportive reading and other material as well as web links will be provided through Moodle.

The students will participate in the planning and selection of the growth conditions to be used by each person/group in the preliminary planning section, so that the effect of different parameters may be analyzed. The students will plan their own laboratory schedules. The students will keep careful lab notes of the work performed. All the results will be compiled and compared at the concluding feedback session.

Target groups

Not compulsory, recommended for students in Master's Programme in Microbiology and Microbial Biotechnology, available for students in other programs (e.g. Genetics and Molecular Biosciences) if places are available.

Teaching period when the course will be offered

Period III, even years

Recommended time or stage of studies for completion

During master degree studies, suitable for 1st year master degree students

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Laboratory protocols and reading material (e.g. scientific articles) provided by the teacher.

MMB-119 Microbial genetics - lab course

MMB-119 Microbial genetics - lab course

MMB-119 Microbial genetics - lab course

Abbreviation: Microbial genet

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Marko Virta, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Bachelor's degree in microbiology, biotechnology or related biosciences. Advanced laboratory course in microbiological research or laboratory research practice in biosciences.

Equivalences to other studies

864039 Laboratory course on microbial genetics (MIKRO560)

Learning outcomes

EN: To learn how to find instructions for laboratory methods in microbial genetics, molecular biology and microbial biotechnology, based on the student's previous knowledge of microbiology and biotechnology. To analyse, present, discuss and report the obtained data.

Content

EN: Laboratory course, oral presentations, group work and writing of the reports. Corresponds to 3 weeks of full time work (100 hours). A laboratory notebook must be kept. The laboratory notebook and all digital records must be submitted at the end of the course. The course includes an oral presentation and a report in the form of a scientific article. Independent work on literature search is expected. The recommended length of the report is 10 pages.

Additional information

EN:

Completion methods

Laboratory research.

Assessment practices and criteria

Assessment consists of the laboratory notebook, performance in the laboratory, seminar and final report in agreement by the supervisors and responsible teacher. The course evaluated on a 0-5 scale.

Activities and methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project.

Target groups

Optional

Teaching period when the course will be offered

Study period III, even years

Recommended time or stage of studies for completion

1st or 2nd year of MSc

Study module

Expiry of studies

10 years

Language of instruction

Teaching in English and in Finnish. All instructions are given in English.

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the teacher including instructions, protocols, laboratory manuals, and scientific articles.

MMB-125 Advanced microbial bioinformatics project in a research group

MMB-125 Advanced microbial bioinformatics project in a research group

MMB-125 Advanced microbial bioinformatics project in a research group

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	10-12 cr
Languages	English, Swedish, Finnish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Marko Virta, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Compulsory prerequisites:

Knowledge on how to use command line interface in computers

Recommended prerequisites:

Learning outcomes

EN: After completion of the course, the student:

- is able to work in a research team
- can write a research plan
- can plan and carry out a project in a scientific, reliable fashion
- can write a short report of the findings based on the results documented in the work notebook
- has practical and theoretical skills in risk assessment for the work

Content

EN:

- Corresponds to 270 h (10 ect) or 324 (12 ect) of full-time work including writing of the final report
- Project plan (max 2 pages) at start of the project including short introduction of the topic and research question, at least 3 key references, main methods, time line, risk assessment, research and learning objectives, supervisors' contact information, connection to other projects.
- Project is carried out with an agreed supervisor.
- A notebook must be kept. The notebook and all digital records must be submitted to the supervisor.
May include an oral presentation.
- Report in the form of a scientific article. Recommended length is 5 pages

Additional information

EN:

Completion methods

Computer work

Assessment practices and criteria

Assessment consists of the research plan (accepted), work note book (30%), performance in the practical work, quality of the research (30%) and final report (40%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Activities and methods in support of learning

Facilitated learning. Supervision, guidelines, and practical help. Feedback and evaluation session in the end of the project

Target groups

Optional for MMB students

Teaching period when the course will be offered

Any time

Recommended time or stage of studies for completion

Any time

Study module

The course is included as optional in Study module MMB-900

Expiry of studies

The course completion expires in 10 years.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Relevant literature provided by the supervisors, e.g. manuals, protocols, articles, web resources

MMB-201 Microbial ecology

MMB-201 Microbial ecology

MMB-201 Miljö mikrobiologi

Abbreviation: Microbial ecology

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Sari Timonen, Responsible teacher

Study level Intermediate studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic knowledge about chemistry, biochemistry and microbial biodiversity and metabolism

Equivalences to other studies

864068 Environmental microbiology (MIKRO241)

Learning outcomes

EN: The student is aware the necessity of microbes in the functions of all earth ecosystems. She understands the role of microbes in the most important cycles of elements. The student is able to assess the state of the environment from the microbiological point of view and has the tools to design microbiological monitoring of the environment. He is also able to evaluate what is going on in the microbial populations as a result of environmental changes and to plan measures to improve the state of the environment.

Content

EN: Microbial ecology of soil and water, biogeochemical cycles of elements, microbial interactions, environmental monitoring, microbial bioremediation, wastewater management.

Additional information

EN:

Completion methods

Lectures remotely, weekly seminars face-to-face

This course can be substituted by a book exam, Kirchman, 2012, Processes in microbial ecology and From: Pepper et al. 2015 Environmental Microbiology 3rd ed. Chapters 17. Microorganisms and Organic Pollutants, 18. Microorganisms and Metal Pollutants and 25. The Nature of Wastewater (Sewage). Contact the responsible teacher for more information about the exam.

Assessment practices and criteria

Estimated on a scale of 0 to 5. Exact criteria can be seen in the Moodle area of the course. The grade is based on coursework/homework as well as written and oral exam.

Activities and teaching methods in support of learning

Lectures, group work, discussions, presentations, panel discussion and homework

Target groups

Open to students of MMB and other degree programmes of both Bachelor's, Master's levels.

Teaching period when the course will be offered

3rd period

Recommended time or stage of studies for completion

During Bachelor's or Master's studies.

Study module

The course is included as compulsory in study module of MMB-600 Microbiology and MMB-200 Environmental microbiology module.

Expiry of studies

10 years

Language of instruction

English

EQF level

Bachelor's / EQF level 6

Study materials

EN: Materials, publications and articles used in course work. Recommended support literature: Brock Biology of Microorganisms.

You may also find these helpful: Kirchman, 2012, Processes in microbial ecology and From: Pepper et al. 2015 Environmental Microbiology 3rd ed. especially chapters 17. Microorganisms and Organic Pollutants, 18. Microorganisms and Metal Pollutants and 25. The Nature of Wastewater (Sewage)

MMB-301 Food Microbiology –literature examination

MMB-301 Food Microbiology –literature examination

MMB-301 Food Microbiology –literature examination

Abbreviation: Food Microbiolo

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Per Saris, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic studies in microbiology, genetics, chemistry and biochemistry.

Recommended optional studies

Food toxicology and risk assessment 5 cr

European food safety 5 cr

Any food science or food technology course

Equivalences to other studies

864065 Food microbiology (MIKRO231)

or

864988 Food Microbiology (MIKRO233)

or

ETK-231 Food Microbiology

Learning outcomes

EN: The student understands how the microbes are distributed into the food chain, the effect of intrinsic and extrinsic factors on microbial growth, how microbes can be inhibited in foods, how microbes are detected, identified and quantified in foods, basics of self-control and HACCP, microbial quality and quality control. The student can explain food spoilage processes and recognize the hazards of food and water pathogenic microorganisms and parasites including toxin production (moulds, cyanobacterial and algae toxins, biogenic amines and prions).

Content

EN: The contents of the course include ecology of microbes, intrinsic and extrinsic factors of food, technology for inhibition of microbes, isolation, detection and typing of microbes, self-control and HACCP, microbiological quality, accreditation, spoilage of foods, and food and waterborne pathogens.

Additional information

EN:

Completion methods

Literature examination. Note that ETK-231 and MMB-301 are corresponding courses. If you have accomplished ETK-231, it is not possible to earn credits from the MMB-301.

Assessment practices and criteria

Literature examination, evaluation according to scale 0-5.

Activities and methods in support of learning

Self-studies consisting of searching for and reading scientific literature and materials available at relevant www-pages of institutions involved in food, water and environmental control like WHO, EFSA, FDA etc.

Course evaluation is based on the examination only.

Target groups

This course is optional and available for students from different options

Teaching period when the course will be offered

I-IV periods, Exam is arranged upon request to per.saris@helsinki.fi.

Recommended time or stage of studies for completion

First year of Master's studies

Study module

Course is elective in MMB-300 study module.

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: J.M. Jay et al. Modern Food Microbiology, 7th edition. Springer Science + Business media Inc. 2005, NY, USA. Parts I, II, III, V and VI. The moodle platform is used to aid the student to find relevant information.

MMB-302 Food and environmental hygiene and control

MMB-302 Food and environmental hygiene and control

MMB-302 Food and environmental hygiene and control

Abbreviation: Food and enviro

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Per Saris, Responsible teacher
Study level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic knowledge in microbiology, genetics and biochemistry.

Equivalences to other studies

864073 Food and environmental hygiene and control (MIKRO575)

or

864989 Food and Environmental Hygiene and Control (MIKRO576)

Learning outcomes

EN: After the course the student knows the most relevant food and water pathogens (prions, viruses, bacteria, molds, yeast, fungi, algae and parasites) and can explain how they can be isolated, identified and typed. The student can describe how the pathogens enter the food and water chain and has basic knowledge of the ecology of the pathogens. The students know the practices used by societies to minimize the problems caused by the food and water transmitted pathogens.

Content

EN: The course concentrates on pathogens transmitted via food and water, how they enter the food and water chain and how they can be isolated, identified and typed. Epidemiological studies, food and water control in Finland and elsewhere, hygiene, self-control, HACCP, and accreditation are included in the content of the course.

Additional information

EN:

Completion methods

The course is based on lectures and self-studies of the student consisting of searching for and reading scientific literature and materials available at relevant www-pages of institutions involved in food, water and environmental control like WHO, EFSA, FDA etc.

Course evaluation is based on the examination only and the lectures are not obligatory.

Assessment practices and criteria

Literature examination, evaluation according to scale 0-5.

Activities and methods in support of learning

The student is searching and reading scientific articles and the relevance of the results in the articles are discussed with the other students and the teacher. Moodle platform is used.

Target groups

This course is optional and available for students from different options. However, the course is compulsory for the Food Microbiology and Biotechnology module.

Teaching period when the course will be offered

II period

Arranged every second year, uneven years. Even years only examinations, no lectures.

Recommended time or stage of studies for completion

First or second year of the Master's studies.

Study module

Compulsory in MMB-300 Food Microbiology and Food Biotechnology.

Expiry of studies

Ten years.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: J.M. Jay et al. Modern Food Microbiology, seventh edition. Springer Science + Business media Inc. 2005, NY, USA. Parts IV, VI and VII. Additional material is found on the Moodle platform.

MMB-303 Food microbiology - lab course

MMB-303 Food microbiology - lab course

MMB-303 Food microbiology - lab course

Abbreviation: Food microbiolo

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Per Saris, Responsible teacher Pauliina Lankinen, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: A basic microbiology laboratory course is obligatory.

Recommended prerequisites

MMB-302 Food and environmental hygiene and control

MMB-301 Food Microbiology –literature examination

Equivalences to other studies

864067 Food Microbiology, Laboratory practicals (MIKRO232)

Learning outcomes

EN: The student can use food microbiology and water standards and methods, and understands the definition of food and water quality. The student has knowledge of food fermentations and experience of one type of food or beverage fermentation. In addition the student can evaluate the microbiological quality of indoor air and report results orally and in written format according to scientific practices.

Content

EN: Standard methods for isolation and recognition of harmful microbes from foods and water, hygiene, microbial quality of indoor air and fermentation of food or beverages.

Additional information

EN:

Completion methods

The course is intensive and require the presence of the student about 8 hours every course day. The work is done in pairs or groups. The student presents two oral presentations and writes a final report of the results. The student search for and read scientific articles related to the topics of the course.

Assessment practices and criteria

Evaluation according to scale 0-5. Oral presentations, written report and performance during the course are assessed.

Activities and methods in support of learning

Target groups

This course is optional in food microbiology and biotechnology module. It is available for students from different disciplines if there is space on the course.

Teaching period when the course will be offered

IV period

Recommended time or stage of studies for completion

First year in MMB programme

Study module

Course is optional in MMB-300 Microbiology and Microbial Biotechnology study module.

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Standard methods (may vary from year to year) and a laboratory course compendium. Scientific literature related to course topics are also used as course material.

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-401 Seminar in evolution of microbial pathogenesis

Abbreviation: Seminar in evol

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Swedish, Finnish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Sarah Butcher, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: The students must have completed their EQ6 studies.

We recommend that you have taken LIB-200 for data searching.

Recommended prerequisites

LIB-200 Information Seeking and Management for Thesis Writers

Equivalences to other studies

528015 Evolution and Genomics of Pathogenic microbes

or

528035 Evolution of bacterial pathogens - a seminar

Learning outcomes

EN: On completion of the course, the student will be able to 1) analyse information into components and look for the relationships and ideas between them, 2) to review and summarize the topics in microbial evolution and pathogenicity including viruses, bacteria and eukaryotic species.

Content

EN: The seminar covers recent advances in evolution of microbial pathogenesis

Additional information

EN:

Completion methods

Seminar with mandatory face-to-face meetings

Participation in seminar and group work. The course includes compulsory face-to-face meetings and cannot be completed entirely by distance learning.

The course consists of seminars given by the students that are prepared based upon recent, primary literature that they have read within the theme of evolution of microbial pathogenicity, agreed with the instructor. Students write an abstract before their presentation. Students give a 20 minute presentation. Students are expected to attend the seminars of their peers, to chair one other student's presentation, and to give feedback in class anonymously to the speaker. Students will generate, answer, and evaluate questions related to each seminar. At the conclusion of the course, students will update the Wikipedia pages on their seminar topic in Finnish, English, Swedish or their native tongue.

Assessment practices and criteria

Abstract associated with seminar (15%)

Presentation, presentation skills, depth of knowledge, choice of materials, chairing and activity in class (50%)

Questions prepared by the presenter (5%)

Written answers to questions prepared by the presenter (20%)

Wikipedia updates (10%)

Compulsory reflective feedback on own presentation.

Activities and methods in support of learning

International expertise - international staff and students take part in the course. Scientific information seeking of scientific literature. Setting of questions on own presentation to convey key facts. Peer evaluation. Self reflection.

Target groups

MMB students and international exchange students with interest in microbial evolution and pathogenesis.

Teaching period when the course will be offered

period II

Recommended time or stage of studies for completion

Recommended for completion in the first year of studies.

Study module

The course is included as compulsory in study module MMB-400 and is optional in other study modules e.g. MMB-100.

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Literature to be agreed separately:

Literature to be agreed with the person in charge of the course.

MMB-403 Seminar in molecular microbiology

MMB-403 Seminar in molecular microbiology

MMB-403 Seminar in molecular microbiology

Abbreviation: Seminar in mole

Curriculum periods

2023-24, 2024-25, 2025-26

Validity period

since 1 Aug 2023

Credits

5 cr

Languages	English, Swedish, Finnish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Hanna Oksanen, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: The students must have completed their EQ6 (Bachelor level) studies.

We recommend that you have taken LIB-200 for data searching, and GMB-105 for understanding structure and function of molecules

Recommended prerequisites

GMB-105 Introduction to structural biology and biophysics

LIB-200 Information Seeking and Management for Thesis Writers

Equivalences to other studies

52831 Seminar in Molecular Microbiology

Learning outcomes

EN: On completion of the course, the student will be able to 1) analyse information into components and look for the relationships and ideas between them, 2) to review and summarize the chosen topic in molecular microbiology.

Content

EN: The seminar covers recent advances in molecular microbiology

Additional information

EN:

Completion methods

Seminar with mandatory face-to-face meetings

Participation in seminar and group work. The course includes compulsory face-to-face meetings and cannot be completed entirely by distance learning.

The course consists of seminars given by the students that are prepared based upon recent, primary literature that they have read within the theme of Molecular Microbiology., agreed with the instructor. Students write an abstract before their presentation. Students give a 20 minute presentation. Students are expected to attend the seminars of their peers, to chair one other student's presentation, and to give feedback in class anonymously to the speaker. Students will generate, answer, and evaluate questions related to each seminar. At the conclusion of the course, students will update the Wikipedia pages on their seminar topic in Finnish, English, Swedish or their native tongue.

Assessment practices and criteria

Abstract associated with seminar (15%)

Presentation, presentation skills, depth of knowledge, choice of materials, chairing and activity in class (50%)

Questions prepared by the presenter (5%)

Written answers to questions prepared by the presenter (20%)

Wikipedia updates (10%)

Compulsory reflective feedback on own presentation.

Activities and methods in support of learning

International expertise - international staff and students take part in the course. Scientific information seeking

of scientific literature. Setting of questions on own presentation to convey key facts. Peer evaluation. Self reflection.

Target groups

MMB students and international exchange students with interest in molecular microbiology

Teaching period when the course will be offered

period III

Recommended time or stage of studies for completion

Recommended for completion in the first year of studies.

Study module

The course is included as compulsory in study module MMB-400 and is optional in other study modules e.g. MMB-100.

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN:

Literature to be agreed separately:

Literature to be agreed with the person in charge of the course.

MMB-404 Innate immunity -laboratory course

MMB-404 Innate immunity -laboratory course

MMB-404 Innate immunity practicals- lab course

Abbreviation: Innate immun

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Benita Westerlund-Wikström, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Compulsory requisites:

Basic and intermediate studies in microbiology (theory and practice) and immunology.

Recommended prerequisites:

MMB-401, MMB-406 (former MMB-402), MOLE-801, or equivalent.

Recommended prerequisites

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-402 Methods in molecular bacteriology - lab course

MOLE-801 Practical exercises in Bacteriology and Virology

or

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-406 Bacteria-host interactions - laboratory course

MOLE-801 Practical exercises in Bacteriology and Virology

Equivalences to other studies

528050 Innate immunology - practicals

Learning outcomes

EN: After completion of the course, the student can describe main bacterial virulence mechanisms related to innate immune mechanisms of the host. The student can critically read and present original research publications in the field. The student is able to critically evaluate and scientifically report research results.

Content

EN: The focus of the course is on molecular interactions of bacteria with human immune cells during infection. The work includes phagocytosis, apoptosis, bacterial resistance to complement and stimulation of innate immune response.

Additional information

EN: Completion methods

Participation in teaching (laboratory work, pre-meeting and seminars). The course cannot be completed as distance learning.

Assessment practices and criteria

The grade of the course is based on a written report (70%, grading scale 0-5), an oral scientific presentation (30%, scale 0-5) and two laboratory notebooks (graded by pass/fail). The grading matrix and the grading criteria are in Moodle.

Activities and methods in support of learning

Well-structured introduction of the various experiments. Facilitated discussion at the beginning of the course on writing a good report and laboratory notebooks as well as on giving good oral scientific presentations. Feedback on general problems in laboratory notebooks, on presentation and report. Course feedback.

Target groups

Primarily Microbiology and Microbial Biotechnology master students. Secondly Genetics and Molecular Biosciences master students, Molecular Biosciences and Biology bachelor students as well as exchange students, if there is space on the course and the student has appropriate previous studies.

Maximum number of students is 12

Teaching period when the course will be offered

Period 4, odd years

Recommended time or stage of studies for completion

Recommended for completion primarily in the 1st year of master studies or secondarily 3rd year of bachelor studies

Study module

The course is included as optional in Study module MMB-400.

Expiry of studies

The course expires in 10 years. Completion methods for over 10 years old courses has to be agreed with the course responsible teacher.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Course manual and related literature provided during the course in Moodle.

MMB-405 Clinical microbiology -laboratory course (in Finnish)

MMB-405 Kliinisen mikrobiologian erikoiskurssi - laboratorioskurssi

MMB-405 Klinisk mikrobiologi -laboratoriekurs

Abbreviation: Kliinisen mikro

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Taru Meri, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Equivalences to other studies

528052 Special Course in Clinical Microbiology

EN:

Language of instruction

Finnish

MMB-406 Bacteria-host interactions - laboratory course

MMB-406 Bakterii-isäntä vuorovaikutukset -harjoittelutyöt

MMB-406 Bakterie-värd interaktioner - laboratoriekurs

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Benita Westerlund-Wikström, Responsible teacher
Study level	Intermediate studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Compulsory prerequisites:

Bachelor's degree completed

Basic and intermediate studies in microbiology and gene technology (theory and practice)

Recommended prerequisites:

MOLE-801 Bakteriologian ja virologian harjoitustyöt, MMB-401 Seminar in evolution of microbial pathogenesis, MMB-403 Seminar in molecular microbiology, or equivalent

Compulsory prerequisites

MOLE-213C Gene technology practical work

MOLE-212D Laboratory exercises in molecular biology (microbiology)

Recommended prerequisites

MOLE-801 Practical exercises in Bacteriology and Virology

MMB-401 Seminar in evolution of microbial pathogenesis

MMB-403 Seminar in molecular microbiology

Equivalences to other studies

MMB-402 Methods in molecular bacteriology - lab course

Learning outcomes

EN: When completed the course, the student:

- can explain the theory behind the methods used on the course and knows how to apply the theoretical knowledge in practice
- is able to act correctly in biosafety level 2 (BSL2) facilities planned for work with pathogenic bacteria knows the principles of mammalian cell culturing in practice
- can use basic bioinformatics tools in bacteriology
- has improved skills in critical evaluation of obtained results as well as scientific presentation and writing
- is familiar with some important bacterial virulence mechanisms.

Content

EN: The course focuses on methods applied in analysis of bacterial virulence mechanisms and cellular bacteriology. The laboratory work includes study of bacterial invasion of mammalian cells and bacterial interaction with host molecules, mammalian cell culture and work in BSL2 facilities. The course also includes pre-exercises, analysis of bacterial genes and proteins using bioinformatics, writing reports and oral presentation.

Additional information

EN:

Completion methods

Participation in teaching (laboratory work, pre-meetings and seminars). The course cannot be completed as distance learning.

Independent study (pre-exercises, reports, oral presentation)

Assessment practices and criteria

The grade of the course is based on a written report in the format of an original publication (90%, grading scale 0-5), an oral scientific presentation (10%, grading scale 0-5) and compulsory pre-exercises (graded by pass/fail) and assignments (graded by pass/fail). The grading matrix and the grading criteria are in Moodle.

Activities and methods in support of learning

During the laboratory experiments, the student implements in practice techniques in molecular bacteriology to broaden the student's comprehension of techniques applied in bacteriology. The student initiates writing of the final report and is provided feedback during the course to support the writing process. The student presents orally a given course-related subject to practice interpretation of results and oral scientific presentation. The student writes small assignments related to the topic of the course for deeper insight into the field. The student solves basic bioinformatics exercises related to the practical experiments for broadening of the topic. Course feedback.

Target groups

Primarily Microbiology and Microbial Biotechnology master students and secondarily Genetics and Molecular Biosciences master students as well as exchange students (if there is space on the course and the student has appropriate previous studies).

Maximum number of students is 12

Teaching period when the course will be offered

Period 1-2

Recommended time or stage of studies for completion

Recommended for completion in the 1st year of Master's studies

Study module

The course is included as compulsory in Study module MMB-400.

Expiry of studies

The course expires in 10 years. Completion methods for over 10 years old courses has to be agreed with the course responsible teacher.

Language of instruction

English

EQF level

Bachelor's / EQF level 6

Study materials

EN: Course handout and other material to be distributed during the course in Moodle

MMB-502 Microbial biotechnology - lectures & seminar

MMB-502 Mikrobiotekniikka – luennot ja seminaari

MMB-502 Mikrobiell bioteknik - föreläsningar och seminarium

Abbreviation: Mikrobiotekni

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Swedish, Finnish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible persons Marko Virta, Responsible teacher
Kristiina Hilden, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Suitable Bachelors degree

Equivalences to other studies

86481 Microbial Biotechnology (YBIOT315)

Learning outcomes

EN: A student passing this course will be able to

-Critically evaluate the role of micro-organisms in specific biotechnological processes

-Conduct a search for original research literature pertinent to a selected area of microbiology and biotechnology

-Judge the relative support for different perspectives in potentially controversial issues based on a critical and objective analysis of published research

-Communicate complex scientific principles and ideas effectively

Content

EN: The use of biotechnologically important organisms and enzymes and specific biochemical pathways will be studied taking into account the market sizes of the applications. By taking ethical concerns into account, we will also explore where biotechnology may offer an answer to contemporary problems by delving into the past and evaluating the future of the biotechnology industry.

Additional information

EN:

Completion methods

Active participation to the course sessions. Home examination, written report and oral presentation.

Assessment practices and criteria

Scale 0-5. Home examination (50%), written assignments (25%) and oral presentation (25%). All parts must be completed.

Activities and methods in support of learning

The course consists of lectures and seminar presentations given by students in pairs. Seminars are based on the research and review articles provided in Moodle. The students will have short written assignments on the articles they have read. Students submit their slides in Moodle before the seminar presentation. Home exam is based on the topics learned in lectures and seminar presentations.

Target groups

Recommended for students in Master's Programme in Microbiology and Microbial Biotechnology. Available for students in other Master's programmes and exchange students (if places are available).

Teaching period

1st period

Recommended time or stage of studies for completion

First year of MSc

Study module

The course is included as compulsory in Study module MMB-500 (Microbial Biotechnology) and as an optional in Study modules MMB-200, MMB-300, MMB-700

Expiry of studies

The course expires in 10 years

Languages of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Material in Moodle, review and original scientific articles

Credit transfer instructions

EN: Replaces the former course 86481 (YBIOT315) Mikrobibiotekniikka 5 cr.

MMB-503 Production of recombinant proteins - lab course

MMB-503 Production of recombinant proteins - lab course

MMB-503 Production of recombinant proteins - lab course

Abbreviation: Production of r

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Swedish, Finnish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Kristiina Hilden, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Bachelor's degree in molecular biosciences, biotechnology, microbiology or equivalent.

Recommended prerequisites

MMB-502 Microbial biotechnology - lectures & seminar

Equivalences to other studies

864087 Production of recombinant proteins laboratory course (YBIOT565)

Learning outcomes

EN: The student will learn

- to find, interpret and apply the principal experimental research methods of heterologous expression in microbes as eukaryotic host organisms.
- to understand the basic principles of selecting the host organism, expression vector and promoter for heterologous expression, and to comprehend a broad aspect of typical complications related to the production of recombinant proteins.
- to analyse biochemical properties of the produced recombinant protein.

Content

EN: Cultivation and transformation of *Pichia pastoris* -yeast cells, designing expression cassette, selection of transformants, purification and characterization of recombinant proteins (SDS-PAGE, spectrophotometric enzyme assays and determination of protein concentration), and optimization of the recombinant protein expression level.

Additional information

EN:

Completion methods

Laboratory course. Participation in teaching. The course cannot be completed by distance learning. Full attendance is required.

Assessment practices and criteria

The evaluation is based on written tasks (20%), lab book (40%), oral presentation (20%) and performance in the laboratory (20%). Scale 0-5.

Activities and methods in support of learning

The theory and methods are introduced by short lectures. Study materials (laboratory manuals and supportive reading) are provided in Moodle. Pre-assignment is prerequisite for participation. The students will have short written assignments weekly. The students will keep lab notebook of the work performed. All the results will be compiled and compared at the concluding seminar and feedback session.

Target groups

Optional, recommended for students in Master's Programme in Microbiology and Microbial Biotechnology. Available for students in other Master's programmes and exchange students (if places are available).

Teaching period when the course will be offered

3rd period, odd years

Recommended time or stage of studies for completion

First year of MSc

Study module

Microbial Biotechnology (MMB-500), MMB-700

Expiry of studies

The course expires in 10 years.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Literature and other material to be distributed during the course in Moodle.

MMB-504 Microbial Genetics and Bioinformatics - lecture course

MMB-504 Microbial Genetics and Bioinformatics- lecture course

MMB-504 Mikrobgenetik och Bioinformatik - föreläsningskurs

Abbreviation: Microbial Genet

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Ville-Petri Friman, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic knowledge in Genetics and in Microbiology is required (MOLE-102 and MOLE-103 or equivalent).

Learning outcomes

EN: The student knows the principles for microbial inheritance, diversity and evolution.

The student has quite detailed knowledge of replication, transcription and translation in both prokaryotes (bacteria and archaea) and eukaryotes, and the relevant differences between these kingdoms.

The student can explain regulation of microbial gene expression.

The student knows the physiological and mechanistic differences between prokaryotic and eukaryotic gene expression and regulation of gene expression.

The student has a general view of how microbial genetics has been utilized in genetical engineering and in biotechnology.

Content

EN: Principles of microbial inheritance, diversity and evolution, including the generation of mutants, exchange of genetic material, and recombination as drivers of evolution. Also genetics and role of bacteriophages as

well as mobile genetic elements in bacterial evolution and diversity is explained. Attention will be put also on regulation of gene expression and epigenetics. Certain aspects of biotechnology, mainly in nonmedical fields will be taught.

Additional information

EN:

Completion methods

Lectures, where presence is recommended but not mandatory, will be 20h (10 x 2h). These lectures will be also available as video broadcasts on the net, where interaction will be made possible. The videos will be recorded and made available later on the net. Two lecture dates will be allocated for presentations by students in the form of journal clubs where students in groups of 2 – 4 (depending on total number) will explain the essence of 2-5 relevant scientific papers dealing with a specific chosen topic. Preparation for the own presentation at journal club estimated at 40h, and preparation for discussions of presentations by other teams, and preparation for final exam additional 70 h.

Assessment practices and criteria

The course will have a final exam that stands for 60% of the grade. 40% of the grade will be based on the journal club presentation and discussion.

Activities and methods in support of learning

Target groups

Primarily for Master's students in MMB, but open for other degree students as well. Open for exchange students.

Teaching period when the course will be offered

Period II

Recommended time or stage of studies for completion

Study module

Compulsory in MMB-900 module

Expiry of studies

10 years

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Recommended literature: Brock-Microbiology

MMB-505 Principles of RNA Biology

MMB-505 RNA biologian perusteet

MMB-505 Grunderna i RNA biologi

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Peter Sarin, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Compulsory prerequisites:

Basic and intermediate studies in genetics, microbiology, and cell biology (MOLE-102, MOLE-103, MOLE-104, or equivalent knowledge).

Recommended prerequisite:

GMB-202 Essentials of gene regulation & epigenetics or equivalent knowledge

Recommended prerequisites

GMB-202 Essentials of gene regulation & epigenetics

Learning outcomes

EN: Deepens the student's theoretical knowledge in key areas of RNA biology, incl. coding and non-coding RNA, RNAomics, and biotechnical applications. Upon completing the course, the student understands the traditional roles of RNA in the transmission and regulation of genetic information, as well as the emerging roles of RNA in host-pathogen interaction, cell differentiation, and higher-level genomic regulation. The student will obtain insights into key methods and approaches for studying RNA. The students learn to critically evaluate scientific literature and improves their scientific presentation skills.

Content

EN: The course highlights current knowledge on RNA-mediated functions in prokaryotic and eukaryotic organisms. The focus is on RNA in transcription and translation, providing insights into various RNA species (mRNA, rRNA, tRNA, small non-coding RNAs, etc.) and their role as modulators of cellular processes and responses, incl. host-pathogen interaction, environmental adaptation, cell differentiation, and disease. The course introduces key RNAomics approaches and their practical applications. The course also provides an overview of how RNA-based techniques are utilised in biotechnological applications and the outlines potential future advances.

Additional information

EN:

Completion methods

The course is performed as contact teaching consisting of lectures and student seminars. Compulsory attendance is required for all seminars, and at least 80% attendance is required for the lectures. The course includes independent study and course work, such as problem-based learning assignments incl. independent data search and bioinformatics exercises, thematic seminar presentations, and an oral examination.

Assessment practices and criteria

The grade of the course is based on the seminar presentation (40%, grading scale 0-5), an oral exam (60%, grading scale 0-5), and compulsory assignments. The grading matrix and the grading criteria are presented in Moodle.

Activities and methods in support of learning

During the course, the student is presented with key knowledge that transforms the canonical perception of RNA as a genetic intermediate and expands its functional dimension, thereby broadening the student's comprehension of the topic. Problem-based learning approaches are utilised to further the learning objectives and the assignments are monitored and assessed during the course to support the learning process. The student prepares a seminar presentation on a subject related to the course to practice information gathering, interpretation, and processing, as well as scientific communication. Self-assessment of assignments, peer-review of seminar presentations, and course feedback are used.

The teacher tutors the theoretical exercises and preparation of the oral presentation.

Target groups

The course is optional in the Microbial Biotechnology module of the Master's programme in Microbiology and Microbial Biotechnology. The course is also available to students in the Master's programme in Genetics and Molecular Biosciences and to doctoral degree programme students in biosciences, provided there is sufficient space on the course and the student fulfils the prerequisites.

Teaching period when the course will be offered

Period I

Recommended time or stage of studies for completion

Recommended for completion in the first year of study.

Study module

The course is included as optional course in Study module MMB-500 Microbial Biotechnology

Expiry of studies

The course expires in 10 years.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: All course material is available for the participants in Moodle.

MMB-601 Fungi in sustainable biotechnology on renewable natural resources

MMB-601 Sienten biotekniikka uusiutuvien luonnonmateriaalien kestävässä käytössä

MMB-601 Svampar i hållbar bioteknik om förnybara naturresurser

Abbreviation: Sienten biotekn

Curriculum periods 2023-24, 2024-25, 2025-26

Validity period since 1 Aug 2023

Credits 5 cr

Languages English, Finnish, Swedish

Grading scale General scale, 0-5

University University of Helsinki

Responsible organisation Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person Taina Lundell, Responsible teacher

Study level Advanced studies

Study field Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Bachelor's degree with basics in biochemistry, microbiology and molecular biology.

Equivalences to other studies

864062 Biotechnology of fungi and renewable natural materials (YBIOT525)

Learning outcomes

EN: After the course, the student

- can describe fungal diversity and specific features of fungi
- is aware of fungi as important organisms in biotechnology and bioproduction processes
- has gained advanced knowledge on fungal bioconversion abilities for more sustainable use of plant biomass and recycling of wastes
- understands the impact of fungi for human welfare, agriculture and forestry, and sustainability of terrestrial ecosystems

Content

EN: Fungi as organisms and microbes; fungal ecology, genomics, systematics and evolution; fungal applications in agricultural and forest biotechnology processes, in food processing and enzyme production; production of biofuels, biomaterials and natural compounds; bioremediation and biodefence.

Additional information

EN:

Completion methods

Lectures, individual work, readings and writings, weekly seminars and discussions, presentations, group work.

Assessment practices and criteria

Group work, written assignments, peer-review, seminar performance, activity in discussions. Grading according to scale 0-5.

Activities and methods in support of learning

Moodle web course, written assignments, seminar presentation, group work, peer-review, feedback and seminar discussions.

Target group

Optional in Master's studies e.g. in microbiology and microbial biotechnology. Suitable for exchange students (see prerequisites).

Timing

Master's study years 1-2. Study period IV, every second year.

Study module

Optional study in MMB-200, MMB-500 and MMB-700 modules.

Other information

Studies in microbiology, mycology, biochemistry and bioinformatics are recommended prior to attendance.

Language of instruction

English and Finnish. All instructions are given in English.

EQF level

Master's / EQF level 7

Study materials

EN: Selected scientific articles and books. Most relevant material is available at the course Moodle site.

MMB-701 Fungal biology - book exam

MMB-701 Sienten biologia - luennot & seminaari

MMB-701 Svamparnas biologi

Abbreviation: Sienten biologia

Curriculum periods

2023-24, 2024-25, 2025-26

Validity period

since 1 Aug 2023

Credits

5 cr

Languages

Finnish, Swedish, English

Grading scale

General scale, 0-5

University

University of Helsinki

Responsible organisation

Master's Programme in Microbiology and Microbial Biotechnology
100%

Responsible person

Sari Timonen, Responsible teacher

Study level

Intermediate studies

Study field

Fields of education (Ministry of Education and Culture), Natural sci-

Equivalences to other studies

526006 Fungal Systematics

or

864084 The biology of Mycotic (MYKO251)

Learning outcomes

EN: Student knows how fungi differ from other life forms. She/he can describe the structures of fungal cells and mycelia and understands the fundamentals of their functions. She/he can use genetic, physiological and ecological information to solve basic fungus related questions. She/he can find and understand basic genetic information about fungi. She/he knows the main fungal taxa and can use physiological and morphological information to define fungal groups.

Content

EN: Basics about fungal evolution, systematics, cell biology, genetics, physiology, metabolism, reproduction and adaptation to different environments

Additional information

EN:

Completion methods

A book exam Moore D, Robson GD, Trinci APJ. 2011. 21st Century Guidebook to Fungi. It is strongly recommended that Finnish speaking students take the course arranged in the 4th period every second year.

Assessment practices and criteria

Score of 0-5. Written exam

Activities and methods in support of learning

If there are students interested in taking the exam at the same time, study group can be formed with the help of the responsible teacher.

Target groups

Compulsory in the Mycology module.

Teaching period when the course will be offered

Any time.

Recommended time or stage of studies for completion

Any time.

Other information

Book exam available in English. Contact the responsible teacher for details.

Study module

Mycology

Expiry of studies

10 years

Language of instruction

English

Study materials

EN: Moore D, Robson GD, Trinci APJ. 2011. 21st Century Guidebook to Fungi

MMB-803 Virological tools - lab course

MMB-803 Virological tools - lab course

MMB-803 Virological tools - lab course

Abbreviation: Virological tool

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Minna Poranen, Responsible teacher Katri Eskelin, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Basic knowledge on viruses, microbial genetics, and molecular and cell biology. Previous experience on laboratory work and knowledge on gene technology are a prerequisite. MMB-805 Viruses-lectures, MOLE-213 Genetiikka luennot ja harjoitustyöt, MOLE-801 Bakteriologian ja virologian harjoitustyöt, MOLE-105 Biotekniikka, MOLE-103 Mikrobien monimuotoisuus, rakenne ja toiminta, MOLE-212 Molekyylibiotieteiden harjoitustyökurssi, MOLE-205 Mikrobit ja ihminen or other corresponding studies are recommended. Bachelor's degree completed.

Recommended prerequisites

MMB-801 Viruses - lectures

MOLE-213C Gene technology practical work

MOLE-801 Practical exercises in Bacteriology and Virology

or

MMB-805 Viruses lectures

MOLE-213C Gene technology practical work

MOLE-801 Practical exercises in Bacteriology and Virology

Equivalences to other studies

528020 Practical exercises in Virology

Learning outcomes

EN: After completing the course, student will be able to: Describe life cycles of a double-stranded RNA and a single-stranded DNA virus; Recognize the potential of viruses as biotechnological tools; Apply basic techniques in virology and microbial genetics; Execute scientific experiments; Interpret experimental data and make scientific presentations of the results.

Content

EN: Phage display to study protein-protein interactions. Rescue of infectious RNA virus from genomic DNA clones. Production of modified RNA virus carrier state cell lines to produce double-stranded RNA for RNA interference applications.

Additional information

EN:

Completion methods

Contact teaching in laboratory. Presence required.

Assessment practices and criteria

Grading scale is from 0 to 5. Evaluation is based on a written report (50%), laboratory notebook (20%), and performance and activity on the course (30%).

Activities and methods in support of learning

Students plan and execute laboratory experiments and use bioinformatic tools. Students interpret experimental data. Students keep a laboratory notebook and make tables, graphs and figures of their results. Students prepare a report of their work.

Target groups

Students of the Master's Programme in Microbiology and Microbial Biotechnology. Open also for other students interested in virology (if there is space on the course).

Teaching period when the course will be offered

Period IV

Recommended time or stage of studies for completion

In the end of the first year of MSc studies

Study module

Recommended in the MMB-800 Virology module and optional in the MMB-400 Medical Microbiology and MMB-500 Microbial Biotechnology modules of the Master's Programme in Microbiology and Microbial Biotechnology.

Expiry of studies

Ten years from the completion

Language of instruction

Teaching in English

EQF level

Master's / EQF level 7

Study materials

EN: Laboratory manual and relevant literature.

MMB-805 Viruses lectures

MMB-805 Virukset luennot

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Finnish, Swedish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible persons	Minna Poranen, Responsible teacher Sarah Butcher, Responsible teacher Elina Roine, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN:

Recommended prerequisites

Bachelor's degree completed/Understanding of basics in molecular life sciences.

Equivalences to other studies

MMB-802 Viruses - seminar

Learning outcomes

EN: After completing course, student will be able to:

- describe basic characteristics of viruses and their life cycles (host cell entry, genome replication, virion assembly and host exit).
- discuss about the diversity of viruses and their role in the biosphere
- predict viral functions based on their biochemical and structural characteristics
- describe the routes of viral transmission and epidemiological consequences of viruses
- explain the current options for treatment and prevention of viral infections
- recognize the distinctive features of viruses infecting different host organisms.

Content

EN: Molecular aspects of viral structure and life cycle. Distinctive features of viruses infecting different host organisms (prokaryotes, fungi, plants and animals). Impact of viral infection on host organism and epidemiology of infection. Viral evolution and classification.

Additional information

EN:

Completion methods

Exam. Students who sign up for the workshop, participation to the workshop is obligatory.

Assessment practices and criteria

Assessment is based on an exam and activities done during the optional workshop. The grade is the weighted average of the grade of the workshop (15%) and the exam (85%).

Activities and methods in support of learning

Lectures by different lecturers. A optional workshop (4 times 2 hours) is arranged to deepen the basic knowledge in virology (structure, host entry, replication and assembly). Participation is voluntary, but sign up is required, and for signed up students participation is obligatory.

Target groups

Open to all interested students. Recommended for students with a Bachelor's degree in life sciences, or comparable.

Teaching period when the course will be offered

Period III

Recommended time or stage of studies for completion

Recommended for completion on the 1st year of Master's studies.

Study module

Obligatory in the MMB-800 Virology study module. Optional in the BIO-700, MOLE-800, MMB-200, MMB-300, MMB-400 and MMB-600 study modules.

Expiry of studies

Course expires after 10 years. Completion methods for over 10 years old courses has to be agreed with the course responsible teacher.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Lecture material and other material assigned to the course in Moodle. Optional literature includes chapters corresponding to the lecture material from Carter and Sounders "Virology, principles and applications", 2nd Ed.

MMB-901 Microbial Metagenomics

Curriculum periods	2023-24, 2024-25, 2025-26
Validity period	since 1 Aug 2023
Credits	5 cr
Languages	English, Swedish, Finnish
Grading scale	General scale, 0-5
University	University of Helsinki
Responsible organisation	Master's Programme in Microbiology and Microbial Biotechnology 100%
Responsible person	Antti Karkman, Responsible teacher
Study level	Advanced studies
Study field	Fields of education (Ministry of Education and Culture), Natural sciences

Prerequisites

EN: Compulsory prerequisites

Basic knowledge of UNIX

Basic knowledge of bioinformatics, molecular biosciences and microbiology

Bachelor's degree completed

Recommended prerequisites:

Basic knowledge of R programming language

Equivalences (free text field)

EN: Equivalent to other microbial metagenomics courses with similar content and requirements.

Learning outcomes

EN: By completing this course, the students will:

Have a basic understanding of metagenomic sequencing technologies and bioinformatic approaches to analyse metagenomic data

Be able to plan and execute a metagenomic sequencing project depending on the research questions.

Have an up-to-date knowledge on the bioinformatic tools and best practices for the analysis of metagenomes.

Be able to choose and critically evaluate new tools and approaches for specific research question

Have confidence to learn and implement new bioinformatic methods using available documentation

Content

EN: In metagenomics all genetic material (DNA) in a sample matrix is sequenced and analyzed. Culture-dependent methods have obvious biases in microbial ecology, while uncultured taxa comprise a large fraction of microbial communities in complex ecosystems. For this reason, metagenomics has become a widely used tool for the analysis of microbial communities. Metagenomics has also many benefits compared to amplicon sequencing, as it gives information not only on the taxonomic diversity but also on the functional composition of microbial communities. Recent bioinformatic developments now allow the recovery of metagenome-assembled genomes (MAGs) at an incredible depth.

During this course the students will learn state-of-the-art bioinformatic approaches to analyse metagenomic data. The course covers both read-based and assembly-based methods, focusing on the strength of each of these methods depending on the research question. Short-read sequencing technologies are still commonly used in metagenomics, but recent technical advances in long-read sequencing technologies are making long-read sequencing a valid option in metagenomics. Data originating from both short- (e.g. Illumina) and long-read (e.g. Nanopore/PacBio) sequencing platforms will be used in this course to demonstrate their advantages and disadvantages in metagenomics and microbial ecology.

Additional information

EN:

Completion methods

Participation in teaching and practicals. The course cannot be completed as distance learning.

Weekly assessments during the course

Group exam

Assessment practices and criteria

Activity during the course (30 %)

Weekly assessments (30 %)

Group exam (20 %)

Self evaluation (20 %)

Activities and methods in support of learning

Pre-survey, lectures and hands-on exercises, feedback and assessments at the end of each week.

Target groups

Students from master's programme in microbiology and microbial biotechnology are prioritised.

Teaching period when the course will be offered
period 2

Recommended time or stage of studies for completion

Recommended for completion in the 2nd year of master's degree studies

Study module

Compulsory in MMB-900 Microbial bioinformatics

Expiry of studies

The course expires in 10 years.

Language of instruction

English

EQF level

Master's / EQF level 7

Study materials

EN: Course / work handout and other material to be distributed during the course in Moodle / Github