

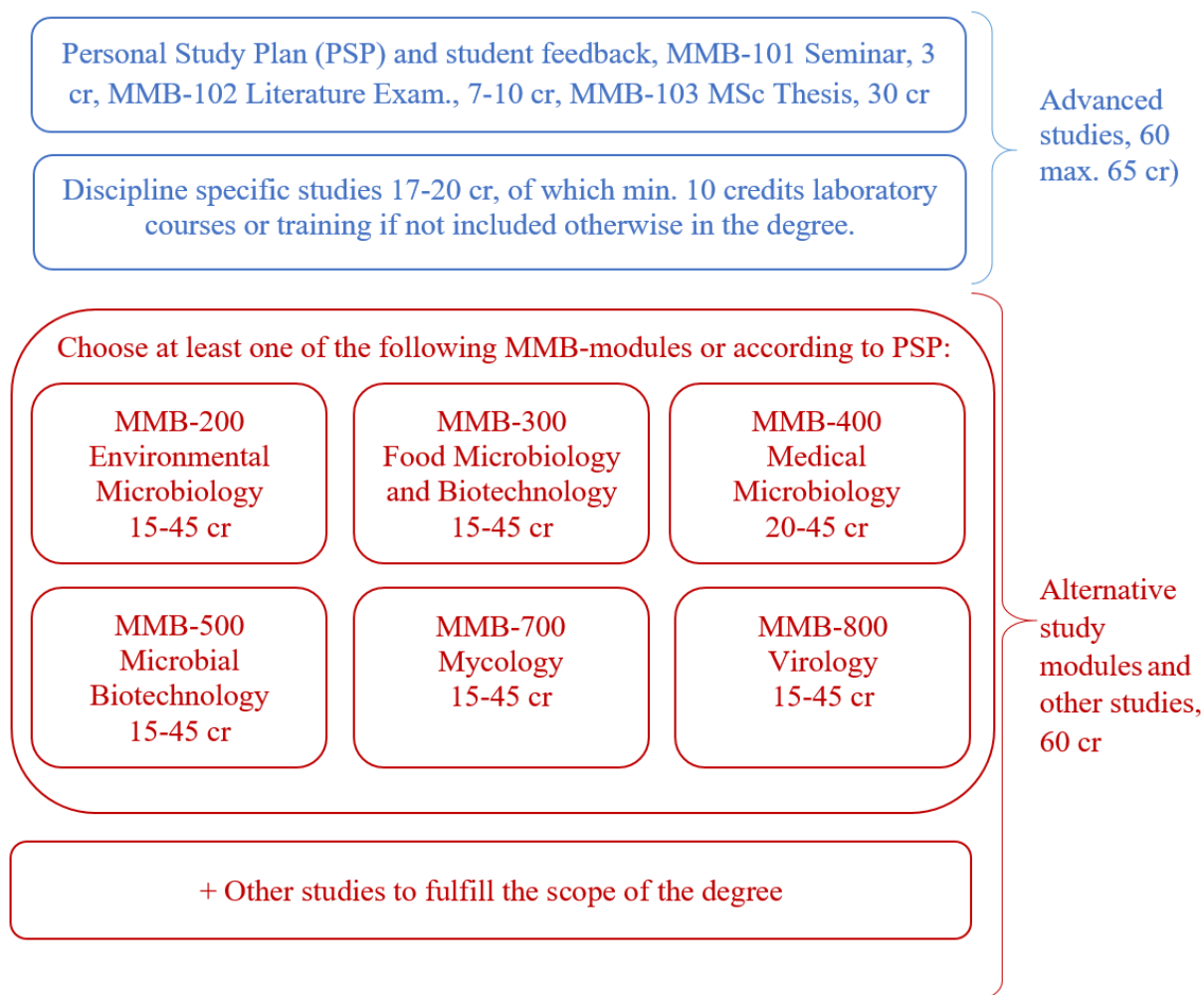
MASTER'S PROGRAMME IN MICROBIOLOGY AND MICROBIAL BIOTECHNOLOGY, CURRICULUM 2020-23 (UPDATES FOR 2021-23)

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Structure of the degree 2020-23



Note that the scope of the modules can be exceeded maximum 5 credits and the scope of the degree can be 120 -135 credits (for students who have started Master's studies after 1.8.2017).

MMB-100 Advanced studies 60 cr

MMB-101 Seminar in microbiology and microbial biotechnology	3	
MMB-102 Literature examination for MSc	7-10	
MMB-103 MSc thesis	30	

And discipline studies together minimum 17-20 cr (see below or according to PSP), of which at least 10 cr of laboratory courses or practical training if not included otherwise in the degree.

Discipline studies of the Microbiology and microbial biotechnology

MMB-105 Biology of Micro-organisms book exam for MSc studies	5 cr	
MMB-106 Teaching practice	1-10 cr	
MMB-107 Advanced bacteriology project in a research group	10-12 cr	
MMB-108 Practical training and report	5 cr	
MMB-109 Advanced biotechnology project in a research group	10-12 cr	
MMB-110 Advanced environmental microbiology project in a research group	10 -12 cr	
MMB-111 Advanced food microbiology project in a research group	10 -12 cr	
MMB-112 Advanced mycology project in a research group	10 -12 cr	
MMB-113 Advanced virology project in a research group	10 -12 cr	
MMB-114 Exploratory microbial research - lab course	15 cr	
MMB-116 Cell biology of viral infection	5 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-201 Ympäristömikrobiologia - luennot & seminaari/Environmental microbiology, book exam	5 cr	5 cr
MMB-302 Food and environmental hygiene and control	5 cr	
MMB-303 Food microbiology - lab course	5 cr	
MMB-301 Food microbiology literature examination	5 cr	
MMB-401 Seminar in evolution of microbial pathogenesis	5 cr	
MMB-402 Methods in molecular bacteriology - lab course	10 cr	
MMB-403 Seminar in molecular microbiology	5 cr	
MMB-404 Innate immunology practicals- lab course*	5 cr	
MMB-405 Kliinisen mikrobiologian erikoiskurssi - lab course*	5 cr	
MMB-501 Biotechnology- from inventions to commercialization	5 cr	
MMB-502 Microbial biotechnology - lectures & seminar	5 cr	
MMB-503 Production of recombinant proteins - lab course*	5 cr	
MMB-504 Microbial genetics - lecture course	5 cr	
MMB-601 Fungi in sustainable biotechnology on renewable natural resources*	5 cr	
MMB-701 Sienten biologia - luennot & seminaari /Fungal biology book exam*	5 cr	
MMB-801 Viruses – lectures	3 cr	
MMB-802 Viruses – seminar	2 cr	
MMB-803 Methods in virology - lab course	5 cr	
GMB-105 Introduction to structural biology and biophysics	5 cr	
MBDP-301 Virus club	1-3 cr	
MBDP-302 Microbiology seminars	1-3 cr	
PROV-407 Advanced immunobiology	5 cr	
VIKIM-100 Courses taken at other Universities	1-15 cr	
VIKIM-200 Study module taken at other University	15-45 cr	

Other suitable courses according to PSP

*Not arranged every year

Alternavite study modules and other studies 60 cr

Studies according to the orientation, including at least one study entity (see below or according to PSP) and other studies together 60 credits.

Studies according to the discipline and orientation

The study entities of Microbiology and microbial biotechnology are primarily suitable for the discipline studies.

Study entities in the Microbiology and microbial biotechnology

MMB-200 Environmental microbiology/Ympäristömikrobiologia	15-45 cr
MMB-300 Food microbiology and biotechnology/ Elintarvikemikrobiologia ja -biotekniikka	15-45 cr
MMB-400 Medical microbiology/Lääketieteellinen mikrobiologia	20-45 cr
MMB-500 Microbial biotechnology/Mikrobibiotekniikka/	15-45 cr
MMB-600 Microbiology/ Mikrobiologia	15-25 cr
MMB-700 Mycology/ Sienitiede	15-45 cr
MMB-800 Virology/Virologia	15-45 cr

Suitable studies or study entities according to the orientation: Microbiology and microbial biotechnology, Aquatic sciences, Bioinformatics, Biochemistry, Ecology and systematics, Food sciences, Pharmacy, Geology, Immunobiology, Biology of plant production, Soil sciences, Mathematics, Forest ecology, Forest pathology, Molecular biology, Multidisciplinary environmental studies, Genetics, Statistics or Environmental change and global sustainability and pedagogical or language and communication studies. When taking courses from other degree programmes it is recommended to agree the studies beforehand with the responsible person of the degree programme or study entity in question.

The study entities are included to the personal study plan (PSP) which is planned together with the assistance of a guiding teacher. If student has accomplished a course included already to another study entity, the course has to be replaced with another course agreed with PSP. Other than master's degree students in Microbiology and microbial biotechnology have to agree to separately attending laboratory courses with the course responsible teacher because the amount of the students might have to be limited.

Contents of the MMB modules

MMB-200 Environmental microbiology / Ympäristömikrobiologia 15-45 cr

Compulsory courses 10 cr

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

MMB-201 Ympäristömikrobiologia luennot & seminaari / Environmental microbiology book exam	5 cr
Either MOLE-103A Mikrobien monimuotoisuus and	2 cr
MOLE-103B Mikrobien rakenne ja toiminta	3 cr
or MMB-105 Biology of Micro-organisms book exam for MSc studies	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-124 Scientific seminars	1-5 cr
MMB-501 Biotechnology - from inventions to commercialization	5 cr
MMB-502 Microbial biotechnology - lectures & seminar	5 cr
MMB-701 Sienten biologia - luennot & seminaari / Fungal biology book exam*	5 cr
MMB-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 cr
ECGS-011 Advanced aquatic and sediment biogeochemistry	5 cr
ECGS-014 Diagnosis of environmental problems in aquatic ecosystems	5 cr
ECGS-041 Advanced course in environmental biotechnology (Lahti)	5 cr
ECGS-043 Environmental remediation (Lahti)	5 cr
ECGS-044 Laboratory course in environmental Biotechnology (Lahti)	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
LSI32001 Introduction to applied bioinformatics	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
ENV-311 Akvaattisten tieteiden perusteet	5 cr
MAAT-021 Maaperätieteen perusteet	5 cr
MOLE-205 Mikrobiit ja ihminen	5 cr
MOLE-105 Biotekniikka	3 cr
VIKIM-100 Courses Taken at Other Universities	1-15 cr
VIKIM-200 Study Module Taken at Other University	15-45 cr
Other suitable courses according to PSP	
* Not arranged every year	

MMB-300 Food microbiology and biotechnology / Elintarvikemikrobiologia ja - biotekniikka 15-45 cr

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
Either MOLE-103A Mikrobien monimuotoisuus and	2 cr
MOLE-103B Mikrobien rakenne ja toiminta	3 cr
or MMB-105 Biology of Micro-organisms book exam for MSc studies	5 cr
* Note that ETK-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-124 Scientific seminars	1-5 cr
MMB-303 Food Microbiology – lab course	5 cr
MMB-501 Biotechnology - from inventions to commercialization	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-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 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
FOR-271 Practical course in bioinformatics	5 cr
GMB-216 Practical course in genome bioinformatics	5 cr
LSI32001 Introduction to applied bioinformatics	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
ETK-221 Mikrobiologian laboratoriotyöt - lab course	3 cr
MOLE-205 Mikrobiit ja ihminen	5 cr
MOLE-105 Biotekniikka	3 cr
VIKIM-100 Courses Taken at Other Universities	1-15 cr
VIKIM-200 Study Module Taken at Other University	15-45 cr

MMB-400 Medical microbiology/Lääketieteellinen mikrobiologia 20-45 cr

Compulsory courses 20 cr

MMB-401 Seminar in evolution of microbial pathogenesis	5 cr
MMB-402 Methods in molecular bacteriology - lab course	10 cr
MMB-403 Seminar in molecular microbiology	5 cr

Optional courses 0-25 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-116 Cell biology of viral infection	5 cr
MMB-119 Microbial genetics - lab course	5 cr
MMB-124 Scientific seminars	1-5 cr
MMB-404 Innate immunology practicals - lab course	5 cr*
MMB-405 Kliinisen mikrobiologian erikoiskurssi - lab course (in Finnish)	5 cr*
MMB-504 Microbial genetics, lecture course	5 cr
MMB-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 cr
MMB-803 Methods in Virology - 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
LSI32001 Introduction to applied bioinformatics	5 cr
MBDP-302 Microbiology seminars	1-3 cr
TMED-915 Introduction to Bioinformatics	5 cr
MOLE-205 Mikrobi ja ihminen	5 cr
MOLE-701 Immunobiology/Immunobiologi	2 cr
MOLE-802 Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
PROV-407 Advanced immunobiology - lectures	5 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr

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

* Will be organized every second year

MMB-500 Microbial biotechnology/Mikrobiotekniikka 15-45 cr

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

MMB-501 Biotechnology - from inventions to commercialization	5 cr
MMB-502 Microbial biotechnology -lectures & seminar	5 cr
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-124 Scientific seminars	1-5 cr
MMB-503 Production of recombinant proteins - lab course	5 cr
MMB-601 Fungi in sustainable biotechnology on renewable natural resources*	5 cr
MMB-803 Methods in virology	5 cr
ECGS-041 Advanced course in environmental biotechnology	5 cr
ECGS-044 Laboratory Course in Environmental Biotechnology	5 cr

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
LSI32001 Introduction to applied bioinformatics	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
YEB-109 Principles of business for bioscientists	2 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr
* Not arranged every year	

MMB-600 Microbiology/Mikrobiologia 15-25 cr

Only offered for students in other degree programmes than MMB.

Compulsory courses 10 cr

Either MOLE-103A Mikrobien monimuotoisuus and	2 cr	
MOLE-103B Mikrobien rakenne ja toiminta	3 cr	
or MMB-105 Biology of Micro-organisms book exam for MSc studies	5 cr	
MMB-201 Ympäristömikrobiologia - luennot & seminaari /Environmental microbiology book exam		5 cr

Optional courses 5 - 15 cr

MMB-108 Practical training and report	5 cr
MMB-118 Metabolic engineering - lab course	5 cr
MMB-701 Sienten biologia - luennot & seminaari / Fungal biology, book exam *	5 cr
MMB-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 cr
ETK-221 Mikrobiologian laboratoriotyöt	3 cr
MOLE-802 Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr

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

* Will not be organized every year

MMB-700 Mycology/Sienitiede 15-45 cr

Compulsory courses 10 cr

AGRI-251 Fungal Plant Pathogens*	5 cr
MMB-701 Sienten biologia / Fungal biology book exam*	5 cr

Optional courses 5-35 cr

Optional studies can be chosen from the list below or agreed upon with the coordinating teacher of the module.

MMB-112 Advanced mycology project in a research group	10 -12 cr
MMB-118 Metabolic engineering- lab course*	5 cr
MMB-124 Scientific seminars	1-5 cr
MMB-201 Ympäristömikrobiologia - luennot & seminaari/Environmental microbiology book exam	5 cr
MMB-502 Microbial biotechnology - lectures & seminar	5 cr
MMB-503 Production of recombinant proteins - lab course*	5 cr
MMB-601 Fungi in sustainable biotechnology*	5 cr
AGRI-261 Ecology and epidemiology of plant pathogens*	5 cr
AGRI-263 Plant microbe interactions	5 cr
FOR-231 Basic application in forestry	5 cr
FOR-232 Forest Microbiology	10 cr

PBIO-161	Biological collections	5 cr
PBIO-171	Boreal lichens and bryophytes*	5 cr
PBIO-172	Polypores as tools in forest conservation	5 cr
ME-225	Metsäpatologian perusteet	6 cr
VIIKM-100	Courses Taken at Other Universities	1-15 cr
VIIKM-200	Study Module Taken at Other University	15-45 cr

* Course is not arranged every year

MMB-800 Virology/Virologia 15-45 cr

Compulsory courses 10 cr

MMB-801	Viruses – lectures	3 cr
MMB-802	Viruses - seminar	2 cr
MMB-803	Methods in Virology - lab course	5 cr

Optional courses 5-35 cr

MMB-108	Practical training and report	5 cr
MMB-113	Advanced virology project in a research group	10 -12 cr
MMB-116	Cell biology of viral infection	5 cr
MMB-124	Scientific seminars	1-5 cr
AGRI-253	Plant virology - includes laboratory work*	5 cr
AGRI-254	Literature in virology	5 cr
DPBM-144	Molecular virology*	4 cr
DPBM-145	Emerging infectious diseases	2 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
LSI32001	Introduction to applied bioinformatics	5 cr
MBDP-301	Virus club	1-3 cr
TMED-503	Infection Biology*	5 cr
TMED-915	Introduction to Bioinformatics	5 cr
ELK-121	Virologia	3 cr
FARM-310	Biologiset lääkevalmisteet II, peruskurssi**	5 cr
MED-828	Lääketieteellinen mikrobiologia ja mikrobilääkkeet (muut kuin LTDK-opiskelijat)	5 cr
MOLE-701	Immunobiology/Immunobiologi	2 cr
MOLE-802	Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
VIIKM-100	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.

Descriptions of the MMB courses

MMB-101 MSc thesis seminar in microbiology and microbial biotechnology, 3 cr

Course title (in Finnish, Swedish and English)

MSc thesis seminar in microbiology and microbial biotechnology

Course code

MMB-101

Course status: compulsory or optional

Compulsory in the Master's Programme in Microbiology and Microbial Biotechnology. Will you accept students from other programmes, e.g. Genetics and Molecular Biology?

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

Microbiology Master's final year

Term/teaching period when the course will be offered

Period II-IV

Scope of the course in credits

3 CR

Teacher coordinating the course

Sarah Butcher

Course learning outcomes

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

Course completion methods

Participation in seminars, written assignments, feedback to other students.

Prerequisites

Participation in the course requires that the student will have started his/her MSc thesis project by the start of Period III, and the thesis supervisor has been identified in Period II.

Recommended optional studies

MMB-102 Literature examination for MSc

Course content

7 minute presentation of the project plan includes the main scientific question, main approaches, time line. All students present on the same day towards the end of Period II, supervisors are expected to be present, along with teachers of the Programme. 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.

Recommended and required literature

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.

Activities and teaching 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.

Assessment practices and criteria, grading scale

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

Language of instruction

English.

Additional information

MMB-102 Literature examination for MSc, 7-10 cr

Course title

Maisterin kirjatentti / Book examination

Course code

MMB-102 (vanha MMTDK 86436)

Course status: compulsory or optional

Pakollinen/ Compulsory

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

Maisterivaiheen toisena opintovuotena / 2nd year of MSc

Term/teaching period when the course will be offered

Yleisinä tenttipäivinä / General examination days

Scope of the course in credits

7-10 cr

Teacher coordinating the course

Kaarina Sivonen, Sarah Butcher, Marko Virta

Course learning outcomes

Opiskelija hallitsee syvällisesti mikrobiologian tieteiden keskeiset käsitteet ja teorian. Hän kykenee selittämään ja kuvaamaan mikrobien biologiaa, systematiikkaa, evoluutiota ja aineenvaihduntaa. Hän hallitsee mikrobiologian termit. Hän osaa soveltaa aikaisemmin oppimaansa tietoa omaan suuntautumisalaansa ja kykenee myös yleistämään tieteellistä tietoa. Hän osaa tehdä johtopäätöksiä lukemastaan

Course completion methods

Kirjallisuuden avulla perehdytään mikrobiologiaan lukemalla ja opiskelemalla itsenäisesti.

Prerequisites

Tentitään kun enemmistö maisterivaiheen opinnoista suoritettuna.

/ Examination after completion most of the Masters degree studies.

Recommended optional studies

Course content

Valitaan Moodle-opetusalustalla olevan tenttikirjallisuusohjeen mukaan.

Recommended and required literature

Kirjallisuus on sovittava etukäteen vastuuprofessorin kanssa. Ilmoita kuulusteltava kirjallisuus tenttiin ilmoittautuessasi. Ilmoittaudu vastuuprofessorille suulliseen kuulusteluun kirjallisen tentin jälkeen.

Activities and teaching methods in support of learning

Assessment practices and criteria, grading scale

Kirjallinen ja suullinen kuulustelu. Arvostelu asteikolla 0-5.

Teaching language

Additional information

Tenttikirjallisuus on esillä Moodle-alustalla MIKROBIOLOGIA – tietoa opinnoista ja opiskelusta.

MMB-103 MSc thesis, 30 cr

Course title

Maisterintutkielma / Magisteravhandling / Master's Thesis

Course code MMB-103

Scope of the course in credits 30 cr

Course status: compulsory or optional

Mikrobiologian ja mikrobiotekniikan opiskelijoille pakollinen opintojakso

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

Recommended time/stage of studies for completion

Pääosin toisen vuoden aikana. Aloitus (ainakin tutkimussuunnitelma) 1. maisterivuoden 3.-4. periodeissa. Kenttä- tai laboratoriotyö tai muu aineiston hankinta ensimmäisen opiskeluvuoden jälkeisenä kesänä tai toisen vuoden syyslukukaudella; aineiston käsittely ja tutkielman kirjoittaminen toisen vuoden syys- tai kevätlukukaudella.

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.

Prerequisites

Opiskelijalla tulee olla aineiston kokoamisen ja käsittelyn vaatimat tiedot ja taidot. Hänen tulee hallita tieteellisen kirjoittamisen käytännöt.

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.

Course learning outcomes

Opintojakson suorittanut opiskelija osaa

- suunnitella ja toteuttaa oman tieteenalansa tutkimuksen
- määritellä tutkimuskohteen ja muodostaa tarkoituksenmukaisia tutkimuskysymyksiä
- jäsentää tutkimuskohteen käsitteellisesti osana laajempaa teoreettista kenttää
- tutkimusaineiston hankinnan keskeiset periaatteet
- tehdä tutkimusmenetelmällisiä valintoja perustellusti ja kriittisesti
- analysoida ja tulkita tutkimusaineistoa monipuolisesti
- laatia tieteellisen tutkimusraportin
- toteuttaa tutkimusprosessin tavoitellussa aikataulussa
- vastaanottaa omaan tutkielmaansa ja tutkimustyöhönsä kohdistuvaa palautetta
- toimia hyvän tieteellisen käytännön periaatteiden mukaisesti.

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.

Course content

Maisterintutkielma perustuu useimmiten kokeelliseen tutkimusprojektiin ja tulosten kriittiseen tarkasteluun tutkimusaiheeseen liittyvän kirjallisuuden avulla. Tutkielma voi olla myös pelkästään kirjallisuuteen tai muuhun tieteelliseen lähdeaineistoon perustuva tutkimustyö. Biologian aineenopettajaksi opiskelevan maisterintutkielma voi käsitellä biologian opetukseen liittyviä kysymyksiä.

Työssä on tyypillisesti neljä vaihetta

1. työn suunnittelu
2. aineiston kerääminen (esim. kenttä- tai laboratoriotyöt, haastattelut, tutkittavan asian alustava mallintaminen)
3. aineiston käsittely (laadun tarkistaminen, tilastolliset analyysit, graafinen esitys)
4. tulosten tulkitseminen ja tarkastelu aiemman kirjallisuuden pohjalta ja tutkielman kirjoittaminen.

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.

Recommended and required literature

Maisterintutkielman aihealueeseen liittyvä kirjallisuus, pääosin kansainvälisiä tieteellisiä julkaisuja. Mainly international, scientific papers depending on the topic of the Master's thesis.

Course completion methods

Hyväksyminen ja arvosana perustuvat opiskelijan kirjoittamaan maisterintutkielmaan. Tutkielmaa ei ole mahdollista hyväksyä ennen kuin opiskelija on suorittanut hyväksytysti kypsyysnäytteen.

Maisterintutkielma on kirjallinen työ, joka koostuu empiirisestä osasta ja sen kriittisestä tarkastelusta tutkimusaiheeseen liittyvän kirjallisuuden avulla. Tutkielman laajuus on 20-30 sivua.

Tutkielman teko on pääosin itsenäistä työskentelyä, mutta työllä on aina ohjaaja. Työ tehdään useimmiten tutkimushankkeessa, jossa opiskelijalla on itsenäinen ja selkeä rooli. Tutkielma on kirjoitettava itse. Työhön (30 cr) menevä aika on noin 4,5 kk eli 800 työtuntia eli 40 tuntia 20 viikon aikana. Esimerkiksi: työn suunnittelu 2 viikkoa, aineiston kerääminen 2 kk, aineiston käsittely 1kk, tulosten tulkitseminen ja tarkastelu aiemman kirjallisuuden pohjalta ja tutkielman kirjoittaminen 1 kk.

Tarkempi kuvaus ja ohjeet maisterintutkielmaa varten löytyvät tiedekunnan maisterintutkielman yleisohjeista.

Approval and grading is based on the written Master's thesis. The thesis cannot be approved until the student has passed the maturity test.

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. 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.

Assessment practices and criteria, grading scale

Tutkielman arvioinnissa käytetään yliopiston ja tiedekunnan hyväksymiä arviointikriteerejä. Arviointi tehdään asteikolla 0-5.

The MSc thesis will be graded on the scale according the guidelines set by the University and the Faculty. (flamalinkki tähän).

Teacher coordinating the course

Sarah Butcher (Cell and Molecular Biology of Prokaryotes)
Per Saris (Food Microbiology)
Kaarina Sivonen (Environmental Microbiology)
Marko Virta (Biotechnology)

Relations to other study units

Kypsyysnäyte. Kypsyysnäyte suoritetaan omassa koulutusohjelmassa. Tutkielmaa ei voi hyväksyä ennen kuin kypsyysnäyte on suoritettu.

The maturity test. The student must take the maturity test and register for the test as stipulated by the programme. The Master's thesis cannot be approved until the student has passed the maturity test.

Additional information

Maisterintutkielmaa ei saa aloittaa ennen kuin maisterintutkielman suunnitelma on hyväksytty. Lisätietoja, ks. maisterintutkielman yleisohjeet.

Jokaisella tutkielmantekijällä on oltava nimetty ohjaaja (PI; professori, yliopistonlehtori tai muu alan asiantuntija).

Tutkielma voidaan kirjoittaa englanniksi tai opiskelijan äidinkielellä, mikäli se on suomi tai ruotsi.

Biologian aineenopettajaksi opiskelevan maisterintutkielma voi käsitellä biologian opetukseen liittyviä kysymyksiä.

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 at the university or elsewhere.

The thesis can be written in English or in the student's native language (if Finnish or Swedish).

MMB-105 Biology of Microorganisms –literature examination for MSc degree, 5 cr

Course title:

Biology of Microorganisms -kirjatentti mikrobiologian maisterintutkintoon
Biology of Microorganisms -literatur exam for magister exam
Biology of Microorganisms –literature examination for Master of Science degree

Course code

MMB-105

Course status: compulsory or optional

This course is optional and available for students from different options
Opintojakso on tarjolla muiden koulutusohjelmien opiskelijoille

Course level

Alempi korkeakoulututkinto/EQF-taso 6/ ja Ylempi taso 7

Recommended time/stage of studies for completion

Ensimmäisenä vuotena
Första året
First year

Term/teaching period when the course will be offered

I-IV periods

Every year 10 exams are arranged.

Scope of the course in credits

4-5 cr

Teacher coordinating the course

Per Saris

Course learning outcomes

Kirjallisen tentin jälkeen opiskelija ymmärtää mikrobien monimuotoisuutta, solubiologiaa, evoluutiota, aineenvaihduntaa, kasvua ja genetiikkaa. Perustavoite on oppia analysoimaan mikrobisolujen toimintaa itsenäisinä solueliöinä ja eliöyhteisöissä. Opiskelija osaa arvioida mikrobien kokonaismerkitystä unohtamatta historiallisia yhteyksiä mikrobiologisen tiedon vaikutuksista ihmisyyhteiskuntien kehityksessä ja tulevaisuudessa.

Studeranden förstår mikrobernas mångfald, cell biologi, evolution, ämnesomsättning, tillväxt och genetik. Ett mål är att lära sig analysera mikrob cellernas funktion som självständiga cell enheter och i organisms samfund. Studeranden kan bedöma mikrobernas helhetsbetydelse utan att glömma historiska förbindelser mellan mikrobiologisk kunskap och samhällsutvecklingen.

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.

Course completion methods

Kirjatentti

Literatur exam

The course is a literature examination.

Prerequisites

Perustiedot kemiassa ja biokemiassa

Baskunskaper i kemi och biokemi

Basic knowledge in chemistry and biochemistry.

Recommended optional studies

Kemian, biokemian, genetiikan ja biotekniikan kursseja

Kurser i kemi, biokemi, genetik och bioteknik

Courses in chemistry, biochemistry, genetics and biotechnology

Course content

Mikrobien metabolia ja genetiikka, evoluutio, mikrobien monimuotoisuus, mikrobiekologia, immunologia ja mikrobitalit, mikrobiit teollisuudessa ja tutkimuksessa.

Mikrobernas metabolism, genetik, evolution, mångfald, ekologi, immunologi samt sjukdomar orsakade av mikrober, roll i industrin och forskning.

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

Recommended and required literature

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.

Activities and teaching methods in support of learning

Assessment practices and criteria, grading scale

Kirjatentti, arvioidaan asteikolla 0–5

Literatur exam, bedömning i skalan 0-5

Literature examination, evaluation according to scale 0-5.

Language of instruction

Englanti
Engelska
English

Additional information

Opiskelijan aiempien opintojen perusteella sovitaan mitkä osat kirjasta tentitään.
På basen av studerandens tidigare studier avgörs vilka kapitel i boken ingår i examen.
The part of the book included in the examination are chosen based on the student's earlier studies.

MMB-106 Teaching practice, 1-10 cr**Course title**

Teaching practice / Opetusharjoittelu / Undervisningsövning

Course code

MMB-106

PAKOLLISUUS/VALINNAISUUS

Optional

Course level

Ylempi korkeakoulututkinto/EQF-taso 7
Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st and 2nd year of MSc

Term/teaching period when the course will be offered

Any period

Scope of the course in credits

1-10

Teacher coordinating the course

Sari Timonen, Taina Lundell, Pauliina Lankinen, Kristiina Hildén

Course learning outcomes

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.

OPINTOJAKSON TOTEUTUS

Teaching activities.

Prerequisites

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

Recommended optional studies

Pedagogical studies

Course content

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

Recommended and required literature

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.

Activities and teaching methods in support of learning

Supervision, guidelines and practical help for teaching.

Assessment practices and criteria, grading scale

Pass-fail

Language of instruction

English, Finnish or Swedish

Additional information**MMB-107 Advanced bacteriology project in a research group, 10-12 cr****Course title**

Advanced bacteriology project in a research group

Course code

MMB-107

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10–12 cr

Teacher coordinating the course

Sarah Butcher

Course learning outcomes

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).

Course completion methods

Laboratory research.

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Seminar in evolution of microbial pathogens MMB-401 or Seminar in Molecular Microbiology MMB-403, Exploratory microbial research, lab course, MMB-114 or Methods in molecular bacteriology - lab course MMB-402

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

MMB-108 Practical training and report, 5 cr**Course title**

Harjoittelu ja harjoittelukertomus/Practical training and report in microbiology and microbial biotechnology

Course code

MMB-108

Course status: compulsory or optional

Valinnainen opintojakso mikrobiologian ja mikrobibiotekniikan maisteriohjelmassa.

/ Optional in Master's studies in microbiology and microbial biotechnology.

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

Maisteriopinnoissa vuodet 1-2.

/ Master's study years 1-2

Term/teaching period when the course will be offered

Ei ole sidottu opetusperiodeihin, suositellaan kesäaikana suoritettavaksi.

/ All study periods, preferably summertime.

Scope of the course in credits

5 cr

Teacher coordinating the course

N.N.

Course learning outcomes

Opiskelija osaa harjoittelun jälkeen työskennellä turvallisista ja hyväksytyistä työtapoja noudattaen mikrobiologian alan laboratorioissa sekä laatia harjoittelustaan kirjallisen, pohtivan selostuksen.

Course completion methods

Työharjoittelua mikrobiologian tai biotekniikan tutkimus- tai seurantalaboratoriossa tai esim. kenttätutkimuksessa. Ohjeiden mukaisen harjoitteluraportin kirjoitus ja palautus. Hyväksytty raportti on edellytys suoritukselle.

Prerequisites

Kandidaatin tutkinto tai vastaavat opinnot mikrobiologiassa tai biotekniikassa
/ Bachelor's degree or corresponding studies in microbiology or biotechnology

Recommended optional studies

Advanced projects in a research group 10 cr

Course content

Noin kolmen kuukauden pituinen työharjoittelu tehdään mieluiten yliopiston ulkopuolisessa mikrobiologian alan laboratorioissa tai soveltuvassa tutkimuslaitoksessa tai yrityksessä. Harjoittelupaikasta, töistä ja ohjauksesta sovitaan vastuuopettajan kanssa. Harjoittelusta kirjoitetaan ohjeiden mukainen raportti.

Recommended and required literature

Työharjoittelun aihepiiriin liittyvää kirjallisuutta.

Activities and teaching methods in support of learning

Moodle-kurssialusta ja urapalveluiden ohjeistus, harjoittelupaikan järjestämä työnohjaus.

Assessment practices and criteria, grading scale

Harjoitteluraportti asteikolla 0-5/5.

Language of instruction

Suomi, ruotsi, englanti.

Additional information

Työharjoitteluun on mahdollista hakea harjoittelutukea yliopiston urapalveluiden kautta tai työharjoittelu voi olla myös palkallinen kesätyö. Harjoittelusta ja harjoittelupaikasta sovitaan etukäteen vastuuopettajan kanssa. Maisteriopintoihin voi sisältyä kaksi työharjoittelu -opintojaksoa.

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

Course title

Advanced biotechnology project in a research group

Course code

MMB-109

Course status: compulsory or optional: Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10–12 cr

Teacher coordinating the course

Kristiina Hildén

Course learning outcomes

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).

Course completion methods

Laboratory research.

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Exploratory microbial research, lab course, MMB-114

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

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

Course title

Advanced environmental microbiology project in a research group

Course code

MMB-110

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10–12 cr

Teacher coordinating the course

Kaarina Sivonen, Taina Lundell

Course learning outcomes

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).

Course completion methods

Laboratory research.

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Exploratory microbial research; lab course; MMB-114

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

MMB-111 Advanced food microbiology project in a research group, 10-12 cr**Course title**

Advanced food microbiology project in a research group

Course code

MMB-111

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10–12 cr

Teacher coordinating the course

Per Saris

Course learning outcomes

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).

Course completion methods

Laboratory research

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Exploratory microbial research, lab course, MMB-114

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

MMB-112 Advanced mycology project in a research group, 10-12 cr

Course title

Advanced mycology project in a research group

Course code

MMB-112

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10 CR

Teacher coordinating the course

Sari Timonen

Course learning outcomes

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).

Course completion methods

Laboratory research.

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Exploratory microbial research, lab course, MMB-114

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

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

Course title

Advanced virology project in a research group

Course code

MMB-113

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Any time

Scope of the course in credits

10–12 cr

Teacher coordinating the course

Minna Poranen

Course learning outcomes

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).

Course completion methods

Laboratory research.

Prerequisites

BSc. Experience of laboratory work.

Recommended optional studies

Methods in Virology - lab course MMB-803 or Exploratory microbial research lab course MMB-114 or Bakteriologian ja virologian harjoitustyöt – lab course MOLE-801 or MOLE-802.

Course content

Ten credits corresponds to 8 weeks of full time work (266 hours) and 12 credits corresponds to 10 weeks of full time work (320 hours).

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

Assessment consists of the project plan (10%), lab book (30%), performance in the laboratory (30%) and final report (30%), evaluated on a 0-5 scale, in agreement by the supervisors and responsible teacher.

Language of instruction

English/Finnish/Swedish

MMB-114 Exploratory microbial research, lab course, 15 cr**Course title**

Exploratory microbial research, lab course/Mikrobiologian tutkiva työkurssi/ Undersökande kurs i mikrobiologisk forskning.

Course code

MMB-114

Course status: compulsory or optional

Optional in Master's studies in microbiology and microbial biotechnology

Course level

Ylempi korkeakoulututkinto/EQF-level 7

Recommended time/stage of studies for completion

Master's study year 1

Term/teaching period when the course will be offered

Study periods I-II

Scope of the course in credits

15 cr

Teacher coordinating the course

Taina Lundell, Sari Timonen

Course learning outcomes

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.

Course completion methods

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

Prerequisites

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

Recommended optional studies

Courses in bioinformatics, genetics and biostatistics.

Course content

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.

Recommended and required literature

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

Activities and teaching 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.

Assessment practices and criteria, grading scale

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

Language of instruction

English and Finnish. All instructions are given in English.

Additional information

Laboratory skills and prior courses in microbiology and biochemistry are compulsory for course attendance.

MMB-116 Cell biology of viral infection, 5 cr**Course title**

Cell biology of viral infection

Course code

MMB-116

Course status: compulsory or optional

Optional in the Virology and Medical microbiology modules of the Master's Programme in Microbiology and Microbial Biotechnology. Also other students interested in virology and cell biology can take the course.

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

1st year of MSc studies

Term/teaching period when the course will be offered

First period

Scope of the course in credits

5 cr

Teacher coordinating the course

Docent Giuseppe Balistreri

Course learning outcomes

After completing the course, the student can explain how the cell reacts to virus infection by giving several examples, explain how viruses use different cellular compartments and machineries for their replication and reflect on the societal impact of virus infections and means for their prevention.

Course completion methods

Contact teaching 28 h. Attendance is compulsory. Written assignments, eLearning and group work.

Prerequisites

Basic knowledge on viruses and molecular and cell biology.

Recommended optional studies

Viruses-lectures, Viruses – seminar, Solubiologia, Mikrobien monimuotoisuus, rakenne ja toiminta, Mikrobit ja ihminen or other corresponding studies. Other courses in virology and cell biology.

Course content

The course covers the host cell structure and functions from the point of view of a virus and viruses as parasites that are in turn constantly shaped by the cellular host. Viral replication cycles are discussed by referring to the normal cell biological function of each involved cellular component and how viral infection affects these functions. Finally the students will reflect on the effects of viral infections at individual and societal level and discuss their ideas how viral infections could be prevented or treated in new ways.

Recommended and required literature

Recommended literature: Molecular Biology of the Cell (Alberts). Principles of Virology (Flint).

Activities and teaching methods in support of learning

Polls and activating questions during the lectures. Use of Virtual lab environment. Written assignment ('news paper article') after interviewing an eminent and a junior scientist. Another written assignment, a 'grant proposal' focusing on one virus presented on the course. Peer-evaluation of 'grant proposals'.

Assessment practices and criteria, grading scale

Grading scale is from 0 to 5. Evaluation is based on two written reports (35% each), and performance and activity on the course and for completing the tasks in the virtual lab (30%).

Language of instruction

English

Additional information

A virtual reality lab eLearning environment will be used during the course.

MMB-117 Environmental microbiology - lab course, 5 cr*

Course title

Environmental microbiology, a laboratory course

Course code

MMB-117

Course status: compulsory or optional

Optional

Course level Higher education certificate/ European Qualifications Framework level 7

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

Term/teaching period when the course will be offered

Study period III, not every year

Scope of the course in credits

5 cr

Teacher coordinating the course

Kaarina Sivonen, Taina Lundell

Course learning outcomes

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

Course completion methods

Laboratory research and sampling, lectures, seminar, written assignments, pair and group work

Prerequisites

BSc with laboratory skills in microbiology and molecular biology

Recommended optional studies

Environmental microbiology

Course content

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

Recommended and required literature

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

Activities and teaching methods in support of learning

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

Assessment practices and criteria, grading scale

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

Language of instruction

English

MMB-118 Metabolic engineering - lab course, 5 cr*

Course title

Metabolic engineering – lab course

Course code

MMB-118

Course status: compulsory or optional

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

Course level EQF-7 (for master degree students)

Recommended time/stage of studies for completion

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

Term/teaching period when the course will be offered Period III

Scope of the course in credits 5 cr

Teacher coordinating the course Tero Ahola

Course learning outcomes

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.

Course 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.

Prerequisites

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.

Recommended optional studies

Many courses in microbiology and biochemistry.

Course content

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.

Recommended and required literature

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

Activities and teaching 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.

Assessment practices and criteria, grading scale

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

Language of instruction English.

Additional information Moodle will be utilized.

MMB-119 Microbial genetics - lab course, 5 cr

Course title

Microbial genetics –lab course

Course code

MMB-119

Course status: compulsory or optional:

Optional

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

1st or 2nd year of MSc

Term/teaching period when the course will be offered

Study period III

Scope of the course in credits

5 CR

Teacher coordinating the course

David Fewer

Course learning outcomes

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

Course completion methods

Laboratory research.

Prerequisites

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

Recommended optional studies

Advanced laboratory course in microbiological research or laboratory research practice in biosciences

Course content

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.

Recommended and required literature

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

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.

Assessment practices and criteria, grading scale

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.

Language of instruction

English and Finnish. All instructions are given in English.

MMB-124 Scientific seminars, 1-5 cr

Course title

Scientific seminars, Tieteelliset seminaarit, Vetenskapliga seminarier

Course code

MMB-124

Course status: compulsory or optional

Optional for students of MMB

Course level

EQF-7

Recommended time/stage of studies for completion

First and second year of MSc studies

Term/teaching period when the course will be offered**Scope of the course in credits**

1-5 cr

Teacher coordinating the course

Per Saris

Course learning outcomes

The student can listen to scientific seminars and evaluate his/her learning from the seminars.

Course completion methods

The student chooses the seminars to attend. They can also be theses defenses or seminars from international or national conferences. The seminars should be from the area of microbiology or closely related like biotechnology, biochemistry, food sciences, environmental sciences, biology, medical area, veterinary sciences etc. The student keeps a learning diary (1 A4). 10 diaries (title of lecture, who presented, when and where, what did I learn and what is still unclear) represents 1 credit.

Prerequisites

Bachelor's degree

Recommended optional studies**Course content**

Listening to seminars from different disciplines will broaden the students view.

Recommended and required literature

No teaching material or literature.

Activities and teaching methods in support of learning**Assessment practices and criteria, grading scale**

Pass-fail

Language of instruction**Additional information**

MMB-201 Ympäristömikrobiologia - luennot & seminaari, 5 cr/ Environmental microbiology book exam

Course title

Ympäristömikrobiologia / Environmental microbiology / Miljö mikrobiologi

Course code

MMB-201

Course status: compulsory or optional

Pakollinen molekyylibiotieteiden kandissa, pakollinen ympäristötieteiden kandissa ympäristömikrobiologian moduulissa, pakollinen mikrobiologian ja mikrobibiotekniikan maisterissa ympäristömikrobiologian opintokokonaisuudessa

Obligatory in the Environmental microbiology module

Course level

Alempi korkeakoulututkinto/EQF-taso 6/ EQF-level 6
 Myös ylempi korkeakoulututkinto/EQF-taso 7/ EQF-level 7

Recommended time/stage of studies for completion

Suositellaan suoritettavaksi 2. -4. opiskeluvuotena/ 2nd-4th study year

Term/teaching period when the course will be offered

Suomenkielinen opetus III periodi/ Book exam arranged with responsible teacher

Scope of the course in credits

5 cr

Teacher coordinating the course

Sari Timonen

Course learning outcomes

Kurssin käynyt opiskelija ymmärtää mikrobien osuuden tärkeimpien alkuaineiden kierrossa ja välttämättömyyden kaikkien maapallon ekosysteemien toiminnassa. Opiskelija pystyy arvioimaan ympäristön tilaa mikrobiologisesta näkökulmasta ja hänellä on välineitä suunnitella ympäristön mikrobiologista seuranta. Hän pystyy myös arvioimaan tutkitun tiedon pohjalta, mitä mikrobistolle tapahtuu ympäristön muutosten seurauksena ja suunnittelemaan toimenpiteitä ympäristön tilan parantamiseksi.

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.

Course completion methods

Lähiopetus

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.

Prerequisites

Mikrobien monimuotoisuus, rakenne ja toiminta, Biokemia, tai vastaavat tiedot/ Basic knowledge about chemistry, biochemistry and microbial biodiversity and metabolism

Recommended optional studies

Maaperätieteen perusteet

Course content

Maa- ja vesiekosysteemien mikrobiologia ja aineiden kierrot, mikrobi-kasvi -vuorovaikutussuhteet, ympäristön kunnostus ja valvonta, jätevesien käsittely ja vaikutus ympäristöön

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

Recommended and required literature

Kurssitoissa käytettävät vaihtuvat julkaisut ja artikkelit. Suositeltava tukikirjallisuus Brock Biology of Microorganisms, 14. painos

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)

Activities and teaching methods in support of learning

Luennot, ryhmätyöt, keskustelut, esitykset, paneelikeskustelu ja kotitehtävät
 Books mentioned above

Assessment practices and criteria, grading scale

Arvioidaan asteikolla 0–5. Arviointiperusteet ovat nähtävillä kurssin Moodle-alueella. Arvosana perustuu kurssityöskentelyyn/kotitehtäviin sekä kirjalliseen ja suulliseen tenttiin.

Written exam with notes. Contact the responsible teacher for details

Language of instruction

Suomi/ Book exam in English

Additional information**MMB-301 Food Microbiology –literature examination, 5 cr****Course title:**

Food Microbiology –literature examination

Course code

MMB-301

Course status: compulsory or optional

This course is optional and available for students from different options

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

First year

Term/teaching period when the course will be offered

I-IV periods

Scope of the course in credits

5 CR

Teacher coordinating the course

Per Saris

Course learning outcomes

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).

Course completion methods

Literature examination

Prerequisites

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

Course content

The Course content 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.

Recommended and required literature

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. Additional material is found on the Moodle platform.

Activities and teaching 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.

Assessment practices and criteria, grading scale

Literature examination, evaluation according to scale 0-5.

Language of instruction

English

Additional information

The moodle platform is used to aid the student to find relevant information. Exam is arranged upon request to per.saris@helsinki.fi. 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.

MMB-302 Food and environmental hygiene and control, 5 cr

Course title:

Food and environmental hygiene and control

Course code

MMB-302

Course status: compulsory or optional

Kurssi on tarjolla myös ympäristötieteiden, elintarviketieteiden, biologian ja molekyylibiotieteiden koulutusohjelmien opiskelijoille sekä muille mikrobiologiasta kiinnostuneille. Elintarvikemikrobiologian ja biotekniikan opintokokonaisuuteen kurssi on pakollinen.

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

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

First or second year

Term/teaching period when the course will be offered

II period, uneven years

Scope of the course in credits

5 CR

Teacher coordinating the course

Per Saris

Course learning outcomes

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.

Course 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.

Prerequisites Basic knowledge in microbiology, genetics and biochemistry.

Recommended optional studies

Food toxicology and risk assessment 5 cr

European food safety 5 cr

Course content

The course concentrate 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.

Recommended and required literature

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.

Activities and teaching 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.

Assessment practices and criteria, grading scale

Literature examination, evaluation according to scale 0-5.

Language of instruction

English

Additional information

Moodle platform is used. The course is arranged every uneven year.

MMB-303 Food microbiology - lab course, 5 cr

Course title:

Food microbiology – lab course

Course code

MMB-303

Course status: compulsory or optional

Kurssi on tarjolla myös ympäristötieteiden, elintarviketieteiden, biologian ja molekyylibiotieteiden koulutusohjelmien opiskelijoille sekä muille mikrobiologiasta kiinnostuneille, jos on tilaa kurssilla. This course is optional and available for students from different options if there is space on the course.

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

First year

Term/teaching period when the course will be offered

IV

Scope of the course in credits

5 CR

Teacher coordinating the course

University lecturer in microbiology and Per Saris

Course learning outcomes

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.

Course 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 one oral presentation and writes a final report of the results.

Prerequisites

A basic microbiology laboratory course is obligatory.

Recommended optional studies

Food microbiology 5 cr

Food and environmental hygiene and control

Course content

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. The student gives an oral presentation of obtained results and a written report.

Recommended and required literature

Standard methods (may vary from year to year) and a laboratory course compendium

Activities and teaching methods in support of learning

The student search for and read scientific articles related to the topics of the course.

Assessment practices and criteria, grading scale

Evaluation according to scale 0-5. Oral presentation (20 %), written report (20 %) and performance during the course (60 %).

Language of instruction

English

MMB-401 Seminar in evolution of microbial pathogenesis, 5 cr**Course title**

Seminar in Evolution of Microbial Pathogenesis

Course code

MMB-401

Course status: compulsory or optional

Compulsory in the Medical Microbiology Module and optional in the Environmental microbiology, Food microbiology and biotechnology, Virology, Microbial biotechnology and Microbiology modules of the Master's Programme in Microbiology and Microbial Biotechnology. Other students interested in molecular biology can also take the course.

Course level

EQF-7

Recommended time/stage of studies for completion

First or second year of MSc studies

Term/teaching period when the course will be offered

Period II every year

Scope of the course in credits

5 cr.

Teacher coordinating the course

Sarah Butcher

Course learning outcomes

The student will understand and communicate science at the forefront of evolution of microbial pathogenesis to peers and throughout reach to local school students.

Course completion methods

One theme is selected each year. The course consists of seminars given by the students, which are based on recent articles in evolution of microbial pathogenesis that they have read. Students write an abstract before their presentation. Students set, answer and evaluate questions on each seminar (peer review). The students prepare joint posters to highlight the common themes emerging from their seminars. The posters are presented to peers, to researchers and staff, and to school students involved in the BioPop programme.

Prerequisites

The students must have completed their EQ6 studies.

Recommended optional studies

Introduction to structural biology and biophysics

Course content

The course covers recent advances in evolution of microbial pathogenesis

Recommended and required literature

Original literature in molecular microbiology.

Activities and teaching methods in support of learning

Active participation in discussions during the seminar sessions. Review and guidance in the preparation of the presentation from the course facilitators and from other participants. Seminar-related questions to reinforce the key points of each topic. Peer evaluation.

Assessment practices and criteria, grading scale

Score of 0-5 with the following % weights:

- presentation skills, depth of knowledge, choice of materials (40%)
- written answers given for the presentation (20%)
- ability to give feedback to peers (10%)
- abstract (10%)
- group poster (10%) (all group members receive the same grade)

Language of instruction

English.

Additional information

MMB-402 Methods in molecular bacteriology - lab course, 10 cr

Course title

Methods in molecular bacteriology - lab course

Course code

MMB-402

Course status: compulsory or optional

The course is compulsory in the Medical Microbiology module of the MSc in Microbiology and Microbial Biotechnology. The course is also available to students from the Bachelor's programmes in Molecular Biosciences, in Biology and in the Master's programme in Genetics and Molecular Biosciences (if there is space on the course and the student has appropriate previous studies).

Course level

Ylempi korkeakoulututkinto/EQF-level 7

Recommended time/stage of studies for completion

Master studies 1st year

Semester/period when the course is arranged

Period I-II

Scope of the course in credits

10 cr

Teacher coordinating the course

Benita Westerlund-Wikström

Course learning outcomes

The course deepens the student's theoretical knowledge and practical skills in key methods applied in cellular bacteriology and analysis of bacterial virulence. When completed the course, the student understands the theory behind the methods used on the course and knows how to apply the theoretical knowledge in practice. The student practices how to use bioinformatics in molecular and cellular bacteriology research. The student learns to critically evaluate obtained results and improves her/his skills in scientific presentation and scientific writing.

Course completion methods

The course is performed as contact teaching in the laboratory for four weeks and full attendance during the entire course is required. The course includes two days of theory prior to the lab course, independent work, pre-exercises, practical laboratory work, processing of experimental results, data search and bioinformatics exercises, oral scientific presentation and two final reports written in the format of original publications.

Prerequisites

Basic and intermediate studies in microbiology and gene technology.

Recommended optional studies

MOLE-801 or MOLE-802 Bakteriologian ja virologian harjoitustyöt, MMB-401 Seminar in evolution of microbial pathogens, MMB-403 Seminar in molecular microbiology, or equal knowledge

Course content

The course focuses on methods applied in analysis of bacterial virulence mechanisms and cellular bacteriology. The course includes analysis of bacterial invasion of eukaryotic cells and bacterial proteolysis of host molecules. The course also includes cloning, expression, purification and functional analysis of bacterial surface proteins as well as analysis of bacterial genes and proteins using bioinformatics.

Recommended and required literature

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

Activities and teaching methods in support of learning

The student implements during the practical laboratory experiments key research techniques in molecular bacteriology that broadens the student's comprehension of the techniques applied. Writing of the final reports is performed and assessed during the time of the course to support the writing process. The student gives a presentation on a subject related to the course or of the laboratory results to practice interpretation of results and oral scientific presentation. The student solves theoretical bioinformatics exercises related to the two practical experiments for broadening of the topic. Course feedback.

The teacher tutors the lab work, theoretical exercises and preparation of oral presentations. The teacher tutors writing of the reports throughout the course.

Course evaluation and criteria

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

Teaching language

English

Additional information

All material of the course is available in Moodle for participants.

MMB-403 Seminar in Molecular Microbiology, 5 cr**Course title:**

Seminar in Molecular Microbiology

Course code

MMB-403

Course status: compulsory or optional

Compulsory in the Medical Microbiology Module and optional in the Environmental microbiology, Food microbiology and biotechnology, Virology, Microbial biotechnology and Microbiology modules of the Master's Programme in Microbiology and Microbial Biotechnology. Other students interested in molecular biology can also take the course.

Course level EQF-7

Recommended time/stage of studies for completion First or second year of MSc studies

Term/teaching period when the course will be offered

Period III

Scope of the course in credits

5 CR.

Teacher coordinating the course

N.N.

Course learning outcomes

The student will be able to understand and communicate primary results and background information about a topic related to molecular microbiology. The student will also improve their scientific communication skills.

Course completion methods

Students would be expected to attend the seminars of their peers. 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. Students write an abstract before their presentation. 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, or their native tongue.

Prerequisites

The students must have completed their EQ6 studies.

Recommended optional studies

Introduction to structural biology and biophysics

Course content

The course covers recent advances in molecular microbiology

Recommended and required literature

Original literature in molecular microbiology.

Activities and teaching methods in support of learning

Active participation in discussions during the seminar sessions. Review and guidance in the preparation of the presentation from the course facilitators and from other participants. Seminar-related questions to reinforce the key points of each topic. Peer evaluation.

Assessment practices and criteria, grading scale

Score of 0-5

Presentation skills, depth of knowledge, choice of materials (40%) Written answers to questions prepared by the presenter (15%) Abstract associated with seminar (10%) Ability to work with and give feedback to peers in support groups (10%) Questions prepared by the presenter (5%) Wikipedia updates (20%)

Language of instruction

English.

Additional information

MMB-404 Innate immunology practicals- lab course, 5 cr*

Course title

Innate immunology practicals - lab course

Course code

MMB-404

Course status: compulsory or optional

The course is compulsory in the Medical Microbiology module of the Master's program in Microbiology and Microbial Biotechnology and optional primarily for students of the program. The course is also available to students from the Master's program Genetics and Molecular Biosciences and exchange students (if there is space available and the student has appropriate previous studies).

Course level

Ylempi korkeakoulututkinto/EQF-taso 7
Intermediate and Advanced studies

Recommended time/stage of studies for completion

Master studies 1st year

Term/teaching period when the course will be offered

Every second year (odd years) period IV

Scope of the course in credits

5 cr

Teacher coordinating the course

Benita Westerlund-Wikström

Course learning outcomes

The course deepens the student's knowledge and skills in bacteria-host interactions during infection. 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.

Course completion methods

The course is performed as contact teaching in the laboratory for three weeks. Full attendance during the entire course is required. The course includes an oral scientific presentation, laboratory notebooks and a final written report.

Prerequisites

Basic and intermediate studies in microbiology and immunology.

Recommended optional studies

MMB-401 Seminar in evolution of microbial pathogens, MMB-402 Methods in molecular bacteriology

Course content

The focus of the course is on molecular interactions of bacteria with human cells. The work includes bacterial adhesion, phagocytosis and stimulation of innate immune response.

Recommended and required literature

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

Activities and teaching methods in support of learning

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

Assessment practices and criteria, grading scale

The grade of the course is based on the written report (70%, grading scale 0-5), the 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.

Language of instruction

English

Additional information**MMB-405 Kliinisen mikrobiologian erikoiskurssi - lab course, 5 cr* (in Finnish)****Course title**

Kliinisen mikrobiologian erikoiskurssi
Specialkurs i klinisk mikrobiologi
Special course in Clinical Microbiology

Course code

MMB-405

Course status: compulsory or optional

Kurssi on valinnainen erikoiskurssi lääketieteelliseen mikrobiologiaan suuntaaville opiskelijoille.

Course level

Alempi korkeakoulututkinto/EQF-taso 6/
Ylempi korkeakoulututkinto/EQF-taso 7

Kurssi sopii aineopintojen loppuvaiheeseen tai syventäviin opintoihin

Recommended time/stage of studies for completion

Kandiopintojen 3. vuosi tai maisteriopintojen 1.vuosi

Term/teaching period when the course will be offered

Joka toinen vuosi periodi IV

Scope of the course in credits

5 cr

Teacher coordinating the course

Taru Meri

Course learning outcomes

Opiskelija osaa käsitellä turvallisesti potilasnäytteitä ja tuntee kliinisesti tärkeiden bakteerien tunnistuksen perusperiaatteet. Opiskelija tuntee joitakin kliinisesti tärkeitä parasiitteja ja sieniä sekä niiden laboratoriodiagnostiikkaa.

Course completion methods

Kurssiin kuuluu luentoja ja lähiopetusta laboratoriossa. Kurssilla on läsnäolopakko. Kurssiin kuuluu laboratoriopäiväkirja, esseen kirjoittaminen, ryhmätyö ja tentti.

Prerequisites

Kurssi edellyttää perus- ja aineopintoja mikrobiologiasta sekä mikrobiologisten peruslaboratoriomenetelmien tuntemusta ja hallintaa. MOLE-103A Mikrobien monimuotoisuus ja MOLE-103B Mikrobien rakenne ja toiminta, MOLE-212 Molekyylibiotieteiden harjoitustyöt, MOLE-205 Mikrobit ja ihminen, tai muita vastaavia opintoja.

Recommended optional studies

MOLE-801 tai MOLE-802 Bakteriologian ja virologian harjoitustyöt, MOLE-703 Infektiaudit ja infektioimmunologia

Course content

Yleisimpien infektiota aiheuttavien bakteerien tunnistus, näytteenkäsittely, sairaalahygienisesti merkittävät löydökset nielu-, virtsa- ja märkäviljelyssä sekä antibiootti- ja herkkyysmääritykset. Tutustutaan yleisimpiin ihmistä infektoiviin parasiitteihin ja sieniin sekä niiden laboratoriodiagnostiikkaan.

Recommended and required literature

Kurssimoniste, luennot ja kurssilla jaettava aihepiiriin liittyvää materiaalia Moodle alueella.

Activities and teaching methods in support of learning

Esitellään selkeät oppimistavoitteet työkohtaisesti. Aktivoidaan osaamista harjoitus- ja tunnistustehtävien avulla kurssin edetessä.

Assessment practices and criteria, grading scale

Tentti, laboratoriopäiväkirja, seminaariesitykset ja essee arvioidaan asteikolla (0-5). Arviointikriteerit kurssin Moodle-alueella.

Language of instruction

Huom! Opetuskielenä on suomi (in Finnish).

Additional information

Ei järjestetä joka vuosi

MMB-501 Biotechnology - From Inventions to Commercialization, 5 cr

Course title:

Biotechnology – From invention to commercialisation

Course code

MMB-501

Course status: compulsory or optional

Course level

EQF-taso 7

Recommended time/stage of studies for completion

Term/teaching period when the course will be offered

I

Scope of the course in credits

3 cr

Teacher coordinating the course

Pauliina Lankinen

Course learning outcomes

A student

- knows the key steps in the research commercialization process
- can identify ideas and opportunities from creating value from research
- can identify career possibilities
- understands what entrepreneurship is
- has gained workplace communication skills
- knows principles and practices of good team work

Course completion methods

Attendance, active participation, teamworks, exercises done within a time frame

Prerequisites

Bachelor's degree

Recommended optional studies

Course content

Topics related to innovations, patenting, licensing, technology transfer from laboratories to companies, financing possibilities, legislation and founding of start-up, teams consisting students develop innovative ideas and pitch the ideas during the course

Recommended and required literature

Material will be provided during the course

Activities and teaching methods in support of learning

Teamworks, exercises done within a time frame,

Assessment practices and criteria, grading scale

Grading scale: 0-5

Teaching language

Additional information**MMB-502 Microbial biotechnology - lectures & seminar, 5 cr****Course title :**

Mikrobibioteknikka –luennot ja seminaari
Mikrobiell bioteknik - föreläsningar och seminarium
Microbial biotechnology - lectures & seminar

Course code

MMB-502

Course status: compulsory or optional**Course level**

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

First year's MSc studies

Term/teaching period when the course will be offered

Period I

Scope of the course in credits

5 CR

Teacher coordinating the course

Marko Virta, Kristiina Hildén

Course learning outcomes

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

Course completion methods

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

Prerequisites

Suitable Bachelors degree

Recommended optional studies**Course content**

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

Recommended and required literature

Material in Moodle, review and original scientific articles

Activities and teaching methods in support of learning

Assessment practices and criteria, grading scale

Scale 0-5. Home examination, written reports and oral presentation each contribute 1/3 of the grade.

Language of instruction

English

Additional information

Korvaa aiemmin kandiopinnoissa olleen Mikrobibiotekniikka-kurssin

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

Course title: Production of recombinant proteins, a laboratory course

Course code:

MMB-503

Course status: compulsory or optional

Optional for master's programme students in microbiology and microbial biotechnology. Also available for students from other master's programme.

Course level: EQF-level 7

Timing: Phase of studies, when the course is completed: First year of MSc

Semester/period when the course is arranged: 3rd period, every second year

Scope of the course in credits: 5 cr

Teacher coordinating the course: Kristiina Hildén

Course learning outcomes

- The student can find, interpret and apply the principal experimental research methods of heterologous expression in microbes as eukaryotic host organisms.
- The student can 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.
- The student can analyse biochemical properties of the produced recombinant protein

Course completion methods

The course comprises laboratory work, oral presentations, and written reports. Full attendance is required.

Prerequisites

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

Recommended optional studies

Recommended previous studies are 86481 Microbial biotechnology, 864039 Microbial genetics, or equivalent theoretical knowledge and laboratory experience on microbial genetics and biotechnology.

Course content

Cultivation and transformation of yeast (*Pichia pastoris*) cells, expression vector construct design, selection of transformants, recombinant protein purification and characterization (SDS-PAGE, spectrophotometric enzyme assays and determination of protein concentration), and optimization of the recombinant protein expression level.

Recommended and required literature

Literature and study material will be given in the course.

Activities supportive for learning

Study materials include laboratory instructions, selected scientific reading and research articles.

Course evaluation and criteria

The evaluation is based on given study tasks (20%), laboratory work book (40%), oral presentation (20%), seminar attendance and participation (20%).

Teaching language: English

Additional information

The course uses Moodle-learning platform. Lectures, instructions and study material are given in English.

MMB-504 Microbial genetics, lecture course, 5 cr**Course title:**

Microbial Genetics; Mikrobigenetiikka; Mikrobgenetik

Course code

MMB-504

Course status: compulsory or optional

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion**Term/teaching period when the course will be offered**

II, 2019-20

Scope of the course in credits

5 cr

Teacher coordinating the course

Prof. Martin Romantschuk

Course learning outcomes

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.

Course 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.

Prerequisites

Basic knowledge in Genetics and in Microbiology is required. Suoritettu MOLE-102 ja 103 tai vastaavat tiedot. Kurserna MOLE-102 och 103 utförda, eller motsvarande kunskaper.

Recommended optional studies

Course content

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.

Recommended and required literature

Activities and teaching methods in support of learning

Assessment practices and criteria, grading scale

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.

Language of instruction

English

Additional information

All lecturing in English. Exam can be taken in English, Suomeksi, på Svenska

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

Course title

Fungi in sustainable biotechnology on renewable natural resources
Sienten biotekniikka uusiutuvien luonnonmateriaalien kestävässä käytössä
Svampar i hållbar bioteknik om förnybara naturresurser

Course code

MMB-601

Course status: compulsory or optional

Optional in Master's studies e.g. in microbiology and microbial biotechnology

Course level

Ylempi korkeakoulututkinto/EQF-taso 7(myös taso 6)

Recommended time/stage of studies for completion

Master's study years 1-2 (or Bachelor's study years 2-3)

Term/teaching period when the course will be offered

Study periods III-IV, every second year.

Scope of the course in credits

5 cr

Teacher coordinating the course

Taina Lundell

Course learning outcomes

The student is able to describe fungal diversity and fungi as important organisms in biotechnology and bioproduction processes. The student will gain knowledge on fungal bioconversion abilities for more sustainable use of plant biomasses and agricultural wastes, and impact of fungi for human welfare, agriculture and forestry.

Course completion methods

Lectures, individual work, seminar and discussions, presentations, group work.

Prerequisites

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

Recommended optional studies

Courses in microbial and forest biotechnology, mycology, and enzymology are recommended.

Course content

Fungi as organisms and microbes, fungal systematics and evolution, traditional fungal biotechnology, fungal applications in industrial, agricultural and forest biotechnology processes, in food processing and enzyme production, production of biofuels and natural compounds, bioremediation of contaminated soils, use of fungi as biodefence agents in agriculture and forestry. Lecture participation, readings, written assignments, weekly seminars, course examination.

Recommended and required literature

Selected scientific articles and books.

Activities and teaching methods in support of learning

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

Assessment practices and criteria, grading scale

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

Language of instruction

English and Finnish. All instructions are given in English.

Additional information

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

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

Course title

Sienten biologia / Fungal biology / Svamparnas biologi

Course code

MMB-701

Course status: compulsory or optional

Pakollinen sienitieteen opintokokonaisuudessa / Compulsory in Mycology module

Course level

Alempi korkeakoulututkinto/EQF-taso 6/ EQF-level 6

Myös ylempi korkeakoulututkinto/EQF-taso 7/ EQF-level 7

Recommended time/stage of studies for completion

Suosittelaa suoritettavaksi 1.-5. opiskeluvuotena. / Any time

Term/teaching period when the course will be offered

IV periodi joka toinen vuosi/ IV period every other year

Scope of the course in credits

5 cr

Teacher coordinating the course

Sari Timonen

Course learning outcomes

Opiskelija tietää, miten sienet eroavat muista eliöistä. Hän osaa kuvata sienisolujen ja rihmastojen rakenteita ja ymmärtää niiden toiminnan perusperiaatteet. Osaa käyttää geneettistä, fysiologista ja ekologista tietoa yksinkertaisten pulmien ratkaisemiseen. Kykenee paikantamaan ja arvioimaan sienten genomitason tietoa. Hän tuntee tärkeimmät sieniryhmät ja osaa käyttää sekä ulkonäköön perustuvia että eri aihealueiden tietoa sieniryhmien määrittelyssä.

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.

Course completion methods

Lähiopetus, suurta osaa käytännön työskentelystä ei voi korvata etätehtävillä

The Finnish contact teaching can be substituted by a book exam Moore D, Robson GD, Trinci APJ. 2011. 21st Century Guidebook to Fungi

Prerequisites

Ei / No

Recommended optional studies

Fungal Plant Pathogens

Course content

Perustiedot sienten evoluutiosta, systematiikasta, solubiologiasta, genetiikasta, fysiologiasta, aineenvaihdunnasta, lisääntymisestä ja sopeutumisesta erilaisiin elinympäristöihin.

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

Recommended and required literature

Pakollinen kirjallisuus: Timonen S & Valkonen J, 2013 Sienten Biologia.

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

Activities and teaching methods in support of learning

Luennot, ryhmätyöt, keskustelut, erilaiset esitykset, kotitehtävät ja demonstraatiot

Not available in English

Assessment practices and criteria, grading scale

Arvioidaan asteikolla 0–5. Arviointiperusteet ovat nähtävillä kurssin Moodle-alueella. Arvosana perustuu kurssityöskentelyyn, kotitehtäviin, ryhmätenttiin sekä projektityöhön. Score of 0-5. Written exam

Language of instruction

Suomi /Book exam available in English

Additional information

Suomenkielinen opetus järjestetään joka toinen vuosi

MMB-801 Viruses – lectures, 3 cr

Course title:

Virukset, Virus, Viruses

Course code

MMB-801

Course status: compulsory or optional

Compulsory in the Virology Module and optional in the Environmental microbiology, Food microbiology and biotechnology, Medical microbiology, Microbial biotechnology and Microbiology modules of the Master's Programme in Microbiology and Microbial Biotechnology. Also other students interested in virology can take the course.

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

1st year in Master's studies

Term/teaching period when the course will be offered

Period III

Scope of the course in credits

3 cr

Teacher coordinating the course of the course

NN

Course learning outcomes

Students can describe the most important steps of a viral life cycle and recognize the similarities and differences among viruses infecting different types of host cells. Students know how viruses spread and can give examples of symptoms of viral infections. Students master the basic concepts of virology and are able to apply those concepts to different situations e.g. in problem-solving. Students are able to evaluate public information about viruses and can critically discuss its validity. Students can describe antiviral strategies used to prevent or cure viral infections.

Course completion methods

Course consists of lectures (16 h) by experts in their field. Lecture attendance is voluntary. The course is assessed using an exam.

Prerequisites

Students understand the basic processes of gene expression as well as prokaryotic and eukaryotic cell structure and function.

Recommended optional studies

Course content

Molecular aspects of viral structure and life cycle. Viruses infecting different host organisms (prokaryotes, plants and animals). Impact of viral infection on host organism and epidemiology of infection.

Recommended and required literature

Lecture handouts (obligatory). Indicated chapters from Carter and Sounders "Virology, principles and applications", 2nd Ed (voluntary).

Activities and teaching methods in support of learning

Activating questions and polls during the lectures for feedback of understanding of the subjects taught on that lecture.

Assessment practices and criteria, grading scale

Evaluation based on exam with grading from 0 to 5 (0=fail).

Language of instruction

English

Additional information**MMB-802 Viruses - seminar, 2 cr****Course title**

Virukset seminaari, Virus seminarium, Viruses seminar

Course code

MMB-802

Course status: compulsory or optional

Compulsory in the Virology Module and optional in the Environmental microbiology, Food microbiology and biotechnology, Medical microbiology, Microbial biotechnology and Microbiology modules of the Master's Programme in Microbiology and Microbial Biotechnology. Also other students interested in virology can take the course.

Course level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

Microbiology Master's 1st year

Term/teaching period when the course will be offered

Period III-IV

Scope of the course in credits

2 cr

Teacher coordinating the course

Ausra Domanska

Course learning outcomes

Students learn to read and interpret the data published in research articles dealing with virology. They learn to find additional background information in order to be able to analyse the research questions and hypotheses of the research article and critically evaluate the quality of the data presented in the article. Seminar develops students' ability to orally present research data and to discuss it with others analytically and critically. Students are prepared for lifelong learning in the role of an expert.

Course completion methods

Seminars attendance, active participation in the discussions and feedback are obligatory.

Prerequisites

Viruses lecture course.

Recommended optional studies

Other virology studies.

Course content

Course deals with research articles of suitable topic in virology and their presentation for active discussions.

Recommended and required literature

Activities and teaching methods in support of learning

Students orientate independently by reading the research articles and finding background information online. Students practice oral presentations and discussions in the group. Teacher supervises the preparation of presentations and discussions.

Assessment practices and criteria, grading scale

Evaluation of the student's performance is based on the presentation, active participation and giving feedback (pass/fail). The criteria for passing the course will be discussed in detail in the first preparative meeting.

Language of instruction

English.

Additional information**MMB-803 Methods in Virology - lab course, 5 cr****Course title:**

Methods in Virology - lab course

Course code

MMB-803

Course status: compulsory or optional

Compulsory in the Virology module and optional in the Medical Microbiology and Microbial biotechnology modules 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).

Course level

Higher education certificate/ European Qualifications Framework level 7

Recommended time/stage of studies for completion

In the end of the first year of MSc studies.

Term/teaching period when the course will be offered

Period IV

Scope of the course in credits

5 CR

Teacher coordinating the course

Katri Eskelin (phage display), Minna Poranen (dsRNA production)

Course learning outcomes

Students can describe life cycles of dsRNA and ssDNA bacteriophages and recognize the differences and similarities in these viruses. Students recognize the potential of viruses as biotechnological tools. Students master RNA work and basic techniques in virology and microbial genetics and can plan and execute scientific experiments. Students know the definition of a helper virus and how infectious viruses can be rescued from genomic clones. Students can interpret experimental data and make scientific presentations of the results.

Course completion methods

Contact teaching in laboratory. Presence required.

Prerequisites

Basic knowledge on viruses, microbial genetics, and molecular and cell biology. Previous experience on laboratory work is a prerequisite. Viruses-lectures, Practical exercises in Bacteriology and Virology, Geeniteknikan harjoitustyökurssi, Biotekniikka - Molekyylibiotieteiden sovelluksia, Mikrobien monimuotoisuus, rakenne ja toiminta, Molekyylibiotieteiden harjoitustyöt, Mikrobit ja ihminen or other corresponding studies.

Recommended optional studies

Course content

Phage display and dsRNA production for RNA interference applications using carrier state cell lines and enzymatic synthesis.

Recommended and required literature

Laboratory manual and relevant literature.

Activities and teaching methods in support of learning

Students plan, execute laboratory experiments and interpret results under the supervision of the teachers. Students keep a laboratory notebook and make tables, graphs and figures of their results. Students prepare reports of their work. Teachers give both written and oral feedback about the reports.

Assessment practices and criteria, grading scale

Grading scale is from 0 to 5. Evaluation is based on two written reports (35% each), laboratory note book (10%) and performance and activity on the course (20%).

Language of instruction English

Additional information

Descriptions of the MMB modules

MMB-100 Advanced studies in Microbiology and microbial biotechnology, 60 cr

Module title

MMB syventävät opinnot MMB fördjupade studier, MMB advanced studies

Module code

MMB-100

Module status: compulsory or optional

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

Module level

Higher education certificate/ European Qualifications Framework level 7
Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

1st and 2nd year of MSc

Scope of the module in credits

60 cr

Teacher coordinating the module

Per Saris

Module learning outcomes

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

Bachelor's degree

Module content

MMB-101 Seminar in microbiology and microbial biotechnology	3
MMB-102 Literature examination for MSc	7-10
MMB-103 MSc thesis	30

And discipline studies together minimum 17-20 cr (see below or according PSP), of which at least 10 cr of laboratory courses or practical training if not included otherwise in the degree.

Discipline studies of the Microbiology and microbial biotechnology

MMB-105 Biology of Micro-organisms book exam for MSc studies	5 cr	
MMB-106 Teaching practice	1-10 cr	
MMB-107 Advanced bacteriology project in a research group	10 cr	
MMB-108 Practical training and report	5 cr	
MMB-109 Advanced biotechnology project in a research group	10-12 cr	
MMB-110 Advanced environmental microbiology project in a research group	10 -12 cr	
MMB-111 Advanced food microbiology project in a research group	10 -12 cr	
MMB-112 Advanced mycology project in a research group	10 -12 cr	
MMB-113 Advanced virology project in a research group	10 -12 cr	
MMB-114 Exploratory microbial research - lab course	15 cr	
MMB-116 Cell biology of viral infection	5 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-201 Ympäristömikrobiologia - luennot & seminaari/Environmental microbiology, book exam	5 cr	5 cr
MMB-302 Food and environmental hygiene and control	5 cr	
MMB-303 Food microbiology - lab course	5 cr	
MMB-301 Food microbiology literature examination	5 cr	
MMB-401 Seminar in evolution of microbial pathogenesis	5 cr	
MMB-402 Methods in molecular bacteriology - lab course	10 cr	
MMB-403 Seminar in molecular microbiology	5 cr	
MMB-404 Innate immunology practicals- lab course*	5 cr	
MMB-405 Kliinisen mikrobiologian erikoiskurssi - lab course*	5 cr	
MMB-501 Biotechnology- from inventions to commercialization	5 cr	
MMB-502 Microbial biotechnology - lectures & seminar	5 cr	
MMB-503 Production of recombinant proteins - lab course*	5 cr	
MMB-504 Microbial genetics - lecture course	5 cr	
MMB-601 Fungi in sustainable biotechnology*	5 cr	
MMB-701 Sienten biologia - luennot & seminaari /Fungal biology book exam*	5 cr	
MMB-801 Viruses – lectures	3 cr	
MMB-802 Viruses – seminar	2 cr	
MMB-803 Methods in virology - lab course	5 cr	
GMB-105 Introduction to structural biology and biophysics	5 cr	
MBDP-301 Virus club	1-3 cr	
MBDP-302 Microbiology seminars	1-3 cr	
PROV-407 Advanced immunobiology	5 cr	
VIIKM-100 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

Module grading

Weighted mean of the grades of the courses (excl. MSc-thesis)

Language of instructions

English and Finnish / englanti ja suomi

Additional information

MMB-200 Environmental microbiology / Ympäristömikrobiologia, 15-45 cr

Module title

Environmental microbiology / Ympäristömikrobiologia

Module code

MMB-200

Module status: compulsory or optional

Valinnainen / Optional

Microbiology and microbial biotechnology master's program / Mikrobiologian ja mikrobiotekniikan koulutusohjelma

Available to students from other programs /Opintokokonaisuus on tarjolla muiden koulutusohjelmien opiskelijoille

Module level

Higher education certificate/ European Qualifications Framework level 7

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

1st and 2nd year of MSc

Scope of the module in credits

15-45 cr

Teacher coordinating the module

Kaarina Sivonen, Taina Lundell

Module learning outcomes

A student who has completed the environmental microbiology module can describe the microbe groups relevant in the environments and understand their functions and significance for humans and nature. Student knows the aspects of diversity, ecology, physiology, genetics and biotechnology of the microbes in the environments. She/he can apply this knowledge widely in environmental microbiology research and environmental monitoring.

Ympäristömikrobiologian opintokokonaisuuden suorittanut osaa kuvata ympäristön kannalta keskeiset mikrobiryhmät ja ymmärtää niiden toimintaa ja merkitystä ihmisen ja luonnon näkökulmasta. Hän osaa perusasiat ympäristömikrobien monimuotoisuudesta, ekologiasta, fysiologiasta, genetiikasta ja biotekniikasta. Hän osaa soveltaa osaamistaan monipuolisesti ympäristömikrobiologian tutkimuksessa ja ympäristön seurannassa. Opintokokonaisuudesta ja valinnaisiin opintoihin sisällytettävistä jaksoista on sovittava ympäristömikrobiologian opintokokonaisuudesta vastaavan opettajan kanssa.

Prerequisites

Bachelor's degree

Module content

Compulsory courses 10 cr

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

MMB-201 Ympäristömikrobiologia luennot & seminaari / Environmental microbiology book exam		5 cr
Either MOLE-103A Mikrobien monimuotoisuus and	2 cr	
MOLE-103B Mikrobien rakenne ja toiminta	3 cr	
or MMB-105 Biology of Micro-organisms book exam for MSc studies	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-124 Scientific seminars	1-5 cr
MMB-501 Biotechnology - from inventions to commercialization	5 cr
MMB-502 Microbial biotechnology - lectures & seminar	5 cr
MMB-701 Sienten biologia - luennot & seminaari / Fungal biology book exam*	5 cr
MMB-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 cr
ECGS-011 Advanced aquatic and sediment biogeochemistry	5 cr
ECGS-014 Diagnosis of environmental problems in aquatic ecosystems	5 cr
ECGS-041 Advanced course in environmental biotechnology (Lahti)	5 cr
ECGS-043 Environmental remediation (Lahti)	5 cr
ECGS-044 Laboratory course in environmental Biotechnology (Lahti)	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
LSI32001 Introduction to applied bioinformatics	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
ENV-311 Akvaattisten tieteiden perusteet	5 cr
MAAT-021 Maaperätieteen perusteet	5 cr
MOLE-205 Mikrobit ja ihminen	5 cr
MOLE-105 Biotekniikka	3 cr
VIIKM-100 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	

Module grading

Painotettu keskiarvo opintojaksoista

Betonat medeltal av kursvitsorden

Weighted mean of the grades of the courses

Language of instruction

English and Finnish / englanti ja suomi

Additional information

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

Opintokokonaisuudesta ja valinnaisiin opintoihin sisällytettävistä jaksoista on sovittava ympäristömikrobiologian opintokokonaisuudesta vastaavan opettajan kanssa.

MMB-300 Food microbiology and biotechnology / Elintarvikemikrobiologia ja –biotekniikka, 15-45 cr

Module title

Elintarvikemikrobiologia ja –biotekniikka
Livsmedelsmikrobiologi och bioteknik
Food microbiology and biotechnology 15-45 cr

Module code

MMB-300

Module status: compulsory or optional

Valinnainen / Optional

Mikrobiologian ja mikrobiotekniikan maisterinohjelma vastaa kokonaisuudesta.

Opintokokonaisuus on tarjolla myös ympäristötieteiden, elintarviketieteiden, biologian ja molekyylibiotieteiden koulutusohjelmien opiskelijoille sekä muille mikrobiologiasta kiinnostuneille.

Module level

Ylempi korkeakoulututkinto/EQF-taso 7

Aine tai syventäviä opintoja riippuen opintokokonaisuuden opintojaksovalinnoista

Recommended time/stage of studies for completion

1st and 2nd year of MSc

Scope of the module in credits

15-45 cr

Teacher coordinating the module

Per Saris

Module learning outcomes

Opiskelija ymmärtää miten ja mitkä mikrobit aiheuttavat haittaa (patogeenit ja pilaajat) elintarvikeketjussa pellostä pöytään ja tunnistaa miten haittoja voi vähentää. Opiskelija tutustuu myös mikrobien hyötykäyttöön elintarvikkeissa sekä ymmärtää miten yhteiskunnat valvovat elintarvikeketjua tavoitteenaan turvata kuluttajille turvallisia elintarvikkeita.

Studeranden förstår hur och vilka mikrober orsakar skada (patogener och förvällare) i livsmedelskedjan från åkern till gaffeln och känner igen hur skadorna kan minskas. Studeranden bekantar sig också med hur mikrober kan nyttjas inom livsmedel och förstår hur samhällen kontrollerar livsmedelskedjan med syfte att försäkra trygga livsmedel åt konsumenten.

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

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.

Module content

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
Either MOLE-103A Mikrobien monimuotoisuus and	2 cr
MOLE-103B Mikrobien rakenne ja toiminta	3 cr
or MMB-105 Biology of Micro-organisms book exam for MSc studies	5-cr

* Note that ETK-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-124 Scientific seminars	1-5 cr
MMB-303 Food Microbiology – lab course	5 cr
MMB-501 Biotechnology - from inventions to commercialization	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-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 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
FOR-271 Practical course in bioinformatics	5 cr
GMB-216 Practical course in genome bioinformatics	5 cr
LSI32001 Introduction to applied bioinformatics	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
ETK-221 Mikrobiologian laboratoriotyöt - lab course	3 cr
MOLE-205 Mikrobi ja ihminen	5 cr
MOLE-105 Biotekniikka	3 cr
VIKIM-100 Courses Taken at Other Universities	1-15 cr
VIKIM-200 Study Module Taken at Other University	15-45 cr

Module grading

Painotettu keskiarvo opintojaksoista

Betonat medeltal av kursvitsorden

Weighted mean of the grades of the courses

Language of instruction

Noin 75 % opetuksesta on englanninkielistä ja noin 25 % suomeksi

Ca. 75 % av undervisningen är på engelska och ungefär 25 % på finska

About 75 % of teaching is in English and about 25 % in Finnish

Additional information

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

MMB-400 Medical microbiology/Lääketieteellinen mikrobiologia, 20-45 cr**Module title**

Medical microbiology/ Lääketieteellinen mikrobiologia/ Medicinsk mikrobiologi

Module code

MMB-400

Module status: compulsory or optional

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.

Module level

EQF-level 7

Recommended time/stage of studies for completion

1st and 2nd year of MSc studies

Scope of the module in credits

20-45 cr

Teacher coordinating the module

Sarah Butcher

Module learning outcomes

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

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.

Module content Mistä opintojaksoista muodostuu

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

Compulsory courses 20 cr

MMB-401 Seminar in evolution of microbial pathogenesis	5 cr
MMB-402 Methods in molecular bacteriology - lab course	10 cr
MMB-403 Seminar in molecular microbiology	5 cr

Optional courses 0-25 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-116 Cell biology of viral infection	5 cr
MMB-119 Microbial genetics - lab course	5 cr
MMB-124 Scientific seminars	1-5 cr
MMB-404 Innate immunology practicals - lab course	5 cr*
MMB-405 Kliinisen mikrobiologian erikoiskurssi - lab course (in Finnish)	5 cr*
MMB-504 Microbial genetics, lecture course	5 cr
MMB-801 Viruses - lectures	3 cr

MMB-802 Viruses - seminar	2 cr
MMB-803 Methods in Virology - 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
LSI32001 Introduction to applied bioinformatics	5 cr
MBDP-302 Microbiology seminars	1-3 cr
TMED-503 Infection Biology**	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
MOLE-205 Mikrobit ja ihminen	5 cr
MOLE-701 Immunobiology/Immunobiologi	2 cr
MOLE-802 Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
PROV-407 Advanced immunobiology - lectures	5 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr

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

* Will be organized every second year

** Will be organized every two or three years

Module grading

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

Language of instruction

English, Finnish

Additional information

Depending on the course, exams and reports can also be done in Finnish or Swedish.

MMB-500 Microbial biotechnology/Mikrobibiotekniikka, 15-45 cr

Module title

Mikrobibiotekniikka, Mikrobiell bioteknologi, Microbial biotechnology

Module code

MMB-500

Module status: compulsory or optional

Optional module in MSc program for Microbiology and Microbial Biotechnology. Available to students from other programs /Opintokokonaisuus on tarjolla muiden koulutusohjelmien opiskelijoille

Module level

Ylempi korkeakoulututkinto/EQF-taso 7

Recommended time/stage of studies for completion

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

Scope of the module in credits

15-45 cr

Teacher coordinating the module

Marko Virta

Module learning outcomes

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

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.

Module content

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

MMB-501 Biotechnology - from inventions to commercialization 5 cr

MMB-502 Microbial biotechnology -lectures & seminar 5 cr

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-124 Scientific seminars 1-5 cr

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

MMB-601 Fungi in sustainable biotechnology on renewable natural resources* 5 crMMB-803

Methods in virology 5 cr

ECGS-041 Advanced course in environmental biotechnology 5 cr

ECGS-044 Laboratory Course in Environmental Biotechnology 5 cr

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

LSI32001 Introduction to applied bioinformatics 5 cr

TMED-915 Introduction to Bioinformatics 5 cr

YEB-109 Principles of business for bioscientists 2 cr

VIKIM-100 Courses Taken at Other Universities 1-15 cr

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

* Not arranged every year

Module grading

Painotettu keskiarvo opintojaksoista

Betonat medeltal av kursvitsorden

Weighted mean of the grades of the courses

Language of instruction

English

MMB-600 Microbiology/Mikrobiologia, 15-25 cr

Module title

Mikrobiologia, Microbiology, Mikrobiologi

Module code

MMB-600

Module status: compulsory or optional

Opintokokonaisuus on tarjolla muiden koulutusohjelmien opiskelijoille
/Available for students of other University level study programmes

Module level

Ylempi korkeakoulututkinto/EQF-taso 7 (Alempi korkeakoulututkinto/EQF-taso 6)
Higher education certificate/ European Qualifications Framework level 7 (also for level 6)

Recommended time/stage of studies for completion

Vuodet 1-2 (maisteriopinnot), vuodet 2-3 (kandidaattiopinnot)
/ Study years 1-2 (Master's level), years 2-3 (Bachelor's level)

Scope of the module in credits

15-25 cr

Teacher coordinating the module**Module learning outcomes**

Opintokokonaisuuden suoritettuaan opiskelijalla on ajantasaista osaamista mikrobien monimuotoisuudesta eri ympäristöissä ja tietoa mikrobien merkittävydestä ekosysteemeille, ihmisen terveydelle ja ihmiskunnan hyvinvoinnille, sekä yksityiskohtaisempaa osaamista eri mikrobiryhmien ja virusten biologiasta, genetiikasta ja toiminnasta.

/

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

Biokemian, molekyylibiologian, biologian ja ympäristötieteiden opintoja suositellaan edeltäviksi opinnoiksi.

Module content**Compulsory courses 10 cr**

Either MOLE-103A Mikrobien monimuotoisuus and	2 cr	
MOLE-103B Mikrobien rakenne ja toiminta	3 cr	
or MMB-105 Biology of Micro-organisms book exam for MSc studies	5-cr	
MMB-201 Ympäristömikrobiologia - luennot & seminaari /Environmental microbiology book exam		5 cr

Optional courses 5 - 15 cr

MMB-108 Practical training and report	5 cr
MMB-118 Metabolic engineering - lab course	5 cr
MMB-701 Sienten biologia - luennot & seminaari / Fungal biology, book exam *	5 cr
MMB-801 Viruses - lectures	3 cr
MMB-802 Viruses - seminar	2 cr
ETK-221 Mikrobiologian laboratoriotyöt	3 cr
MOLE-802 Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr

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

* Will not be organized every year

Module grading

Arvosana muodostuu opintopisteillä painotettuna laskennallisena keskiarvona kokonaisuuteen hyväksytyjen opintojen suorituksista.

Language of instruction

Suomi ja englanti
/ Finnish and English

Additional information

Osa opintojaksoista opetetaan englanniksi. Sovi kokonaisuuden opinnoista mikrobiologian vastuopettajan kanssa.

MMB-700 Mycology/Sienitiede, 15-45 cr**Module title**

Sienitiede / Mycology

Module code

MMB-700

Module status: compulsory or optional

Valinnainen / Optional

Mikrobiologian ja mikrobiotekniikan koulutusohjelma / Microbiology and microbial biotechnology master's program

Opintokokonaisuus on tarjolla muiden koulutusohjelmien opiskelijoille / Available to students from other programs

Module level

Alempi korkeakoulututkinto/EQF-taso 6

Ylempi korkeakoulututkinto/EQF-taso 7

Syventävä opinto

Recommended time/stage of studies for completion

1-5 vuosi / year

Scope of the module in credits

15-45 cr

Teacher coordinating the module

Sari Timonen

Module learning outcomes

Sienitieteen opintokokonaisuuden suorittanut osaa nimetä tärkeimmät sieniryhmät ja tietää niiden erot. Hän tunnistaa tärkeimmät sieniryhmät morfologisten tuntomerkkien perusteella ja ymmärtää perusasiat sienten ekologiasta, fysiologiasta, genetiikasta ja biotekniikasta. Hän osaa myös soveltaa sieniosaamistaan monipuolisesti jollakin valitsemallaan erikoisalalla. Opintokokonaisuudesta ja valinnaisiin opintoihin sisällytettävistä jaksoista on sovittava sienitieteen opintokokonaisuudesta vastaavan opettajan kanssa.

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 take the mycology module a study plan must be negotiated and agreed with the coordinating teacher of the module.

Prerequisites

Ei / No

Module content**Compulsory courses 10 cr**

AGRI-251 Fungal Plant Pathogens*	5 cr
MMB-701 Sienten biologia / Fungal biology book exam*	5 cr

Optional courses 5-35 cr

Optional studies can be chosen from the list below or agreed upon with the coordinating teacher of the module.

MMB-112 Advanced mycology project in a research group	10 -12 cr
MMB-118 Metabolic engineering- lab course*	5 cr
MMB-124 Scientific seminars	1-5 cr
MMB-201 Ympäristömikrobiologia - luennot & seminaari/Environmental microbiology book exam	5 cr
MMB-502 Microbial biotechnology - lectures & seminar	5 cr
MMB-503 Production of recombinant proteins - lab course*	5 cr
MMB-601 Fungi in sustainable biotechnology*	5 cr
AGRI-261 Ecology and epidemiology of plant pathogens*	5 cr
AGRI-263 Plant microbe interactions	5 cr
FOR-231 Basic application in forestry	5 cr
FOR-232 Forest Microbiology	10 cr
PBIO-161 Biological collections	5 cr
PBIO-171 Boreal lichens and bryophytes*	5 cr
PBIO-172 Polypores as tools in forest conservation	5 cr
ME-225 Metsäpatologian perusteet	6 cr
VIIKM-100 Courses Taken at Other Universities	1-15 cr
VIIKM-200 Study Module Taken at Other University	15-45 cr

* Course is not arranged every year

Module grading

Painotettu keskiarvo opintojaksoista

Betonat medeltal av kursvitsorden

Weighted mean of the grades of the courses

Language of instruction

Suomi ja englanti / Finnish and English

Additional information

MMB-800 Virology/Virologia, 15-45 cr

Module title

Virology/Virologia

Module code

MMB-800

Module status: compulsory or optional

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 (see additional information).

Module level

EQF-level 7

Recommended time/stage of studies for completion

1st and 2nd year of MSc studies.

Scope of the module in credits

15-45 CR

Teacher coordinating the module

Minna Poranen

Module learning outcomes

Students will have advanced knowledge of molecular virology. They recognize the diversity of viruses and the global significance of viruses in different biological and environmental systems as well as in the society (human, animal and plant health). Students can describe structural and functional properties of different types of viruses and they know the principles of current viral classification. Students know principles of antiviral strategies, understand virus-host cell interactions, epidemiology, transmission and pathogenesis of viruses. They also recognize the potential of viruses as tools for research, biotechnology and medicine. Depending on the choice of courses by the student, she/he will know how to propagate viruses and study viral infection cycles and structures, can critically evaluate scientific reports and public information about viruses, and can apply obtained information in reporting and presenting projects on viruses. Students will also have better skills in working in teams and be prepared for lifelong professional development as experts.

Prerequisites

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.

Module content

Contact teaching and supervision in laboratory, lectures, seminar work, pair or group work and writing of project reports. Optional studies also include virtual laboratory and research group practices. The virology module is part of the university wide virology education involving five different Faculties.

Compulsory courses 10 cr

MMB-801 Viruses – lectures	3 cr
MMB-802 Viruses - seminar	2 cr
MMB-803 Methods in Virology - lab course	5 cr

Optional courses 5-35 cr

MMB-108 Practical training and report	5 cr
MMB-113 Advanced virology project in a research group	10 -12 cr
MMB-116 Cell biology of viral infection*	5 cr
MMB-124 Scientific seminars	1-5 cr
AGRI-253 Plant virology - includes laboratory work*	5 cr
AGRI-254 Literature in virology	5 cr
DPBM-144 Molecular virology*	4 cr
DPBM-145 Emerging infectious diseases	2 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
LSI32001 Introduction to applied bioinformatics	5 cr
MBDP-301 Virus club	1-3 cr
TMED-503 Infection Biology*	5 cr
TMED-915 Introduction to Bioinformatics	5 cr
ELK-121 Virologia	3 cr
FARM-310 Biologiset lääkevalmisteet II, peruskurssi**	5 cr
MED-828 Lääketieteellinen mikrobiologia ja mikrobilääkkeet (muut kuin LTOK-opiskelijat)	5 cr
MOLE-701 Immunobiology/Immunobiologi	2 cr
MOLE-802 Bakteriologian ja virologian harjoitustyöt -lab course	7 cr
VIIKM-100 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.

Module grading

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

Language of instruction

English and Finnish

Additional information

Depending on the course, English, Swedish and/or Finnish may be used in exams and reports. For students from other MSc programmes, the Methods in Virology course can be compensated with other suitable virology studies.