EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Module handbook

Microbiology and Infection Biology
Master of Science

Valid from Winter Term 2024/25

Faculty of Sciences
Department of Biology
Interfaculty Institute of Microbiology and Infection Medicine (IMIT)

19.10.2023

Contents

1 Programme overview

The Master of Science degree course in Microbiology and Infection Biology is designed to provide high-level qualifications based on the systematic and critical acquisition and augmen-tation of scientific knowledge. The focus of the course is designed to provide knowledge about the diverse life processes of microorganisms. In addition to the genetic, biochemical and bioinformatic study of the metabolic performance of bacteria, the role of microorganisms in pathogenic processes as well as their importance in biotechnological processes are considered. The broad scientific training provided by the course will qualify the graduates for a variety of careers, particularly for research-related positions in scientific institutions specialized in microbiology or biotechnology. It also provides the prerequisites for a subsequent doctorate.

Admission requirements

For admission to the M.Sc. degree in Microbiology and Infection Biology, a B.Sc. degree in biology with a grade of 2.50 or better (German scale equivalent) is required. This degree is designed to run entirely in English. Students can choose to add German courses to their elective module. Proof of English language proficiency at level B2 and German language proficiency at level A2 of the European Framework of Reference for Languages must be supplied. Further details can be found on the website of the Department of Biology.

Successful graduates will:

- have a thorough knowledge of theoretical explanatory approaches, principles and methods in the life sciences, with a focus on the areas of microbiology and infection biology.
- be conversant with the current state of research and capable of challenging it. The in-depth knowledge gained in the field of microbiology and infection biology will benefit graduates in the development and implementation of their own research ideas.
- be able to derive concrete questions from general concepts in the life sciences and to subject them to theoretical and practical analysis, testing and interpretation. In this connection, they will be capable of estimating the relevance and effects of their own professional practice with due regard to ethical principles.
- be able to present, elucidate and discuss the results of their research in front of a scientific audience in German and in English, both orally and in written form.

2 Curriculum

The programme is split into different *Modules* that convey the competences required to successfully complete the programme and enable working in modern research. Some of these modules are *compulsory* while others are *elective*. The topic of the Master thesis is, of course, a free choice[1]. Each *Module* has a certain weight given in ECTS that depends on the contact hours and the time spent into individual self-reliant course work. One ECTS credit point equals a workload of about 30 hours (contact hours + self-reliant work + preparations for the exam). Each year of studies usually yields 60 credits. Module details can be found in the electronic course catalogue ALMA.

2.1 Overview by Modules

Module number	Compulsory/ elective	Module name	Recommended semester	CP
MIB-001	c	Fundamentals of Microbiology and Infection Biology	1	12
MIB-002	c	Methods in Microbiology and Infection Biology	1	15
MIB-003	c	Spotlights on Current Research Topics	1	3
MIB-004	c	Advanced Elective module	2	12
MIB-005	c	Quantitative and Computational Biology	2	6
MIB-006	c	Scientific communication	3	6
MIB-007	c	Research Module 1	3	12
MIB-008	c	Research Module 2	3	12
	e	Interdisciplinary Study Area	1-4	12
MIB-100	c	Master's thesis	4	30
			total[2]	120

[1] The topic must be microbiology or infection biology related
[1] at least 60 CP must be achieved before candidates can be admitted to the master thesis
[2] up to 30 additional credits can be listed in the transcript but will not affect the final grade

2.2 Overview by Study Progress

Semester	Total CP	Module number	compulsory elective	Module name	CP
1	30	MIB-001	c	Fundamentals of Microbiology and Infection Biology	12
		MIB-002	c	Methods in Microbiology and Infection Biology	15
		MIB-003	c	Spotlights on Current Research Topics	3
				$\sum$	30
2	30	MIB-004	c	Advanced Elective module	12
		MIB-005	c	Quantitative and Computational Biology	6
			e	**and/or** Interdisciplinary Study Area	12
				$\sum$	60
3	30	MIB-007	c	Research Module 1	12
		MIB-008	c	Research Module 2	12
		MIB-006	c	Scientific communication	6
			e	**and/or** Interdisciplinary Study Area	
				$\sum$	90
4	30	MIB-100	c	Master's thesis[1]	30
				total[2]	120

[1] at least 60 CP must be achieved before candidates can be admitted to the master thesis
[2] up to 30 additional credits can be listed in the transcript but will not affect the final grade

2.3 Compulsory modules

2.3.1 Fundamentals of Microbiology and Infection Biology

The first part of this module covers the basics of cell biology and metabolism in eukaryotic and prokaryotic cells and is taught together with the Master of Science "Cellular and Immunological Biosciences". Topics that are covered in the lectures and the accompanying tutorials include genome and gene expression, protein structure and function, cell structure and compartmentalization, and metabolism. The second part of the module is specific to bacteria and includes the following topics in the lectures and the accompanying tutorial: bacterial growth, physiology and control, bacterial acclimation and signaling, bacterial evolution and diversity, bacterial ecology, human microbiota and symbionts, mucosal microbiota and immunity, infection biology and antimicrobial therapy.

Study aims

Students will

- acquire interdisciplinary basic knowledge in the fields of microbiology and molecular cell biology and learn to link various areas and paradigms in microbiology.
- be actively involved in seminars and tutorials and acquire the competence to process information from original publications.
- be familiar with scientific terminology in English.

MIB-001	**Fundamentals of Microbiology and Infection Biology**		
Category	compulsory		
ECTS Credits	12		
Workload	360 h	attendance: 120 h (8 class hours)	private study: 240 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture, seminar, tutorial		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** regular attendance of all lectures, seminars and tutorial, presentation in the seminar **Assessment:** written exam		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Forchhammer, K., Link, H.		

2.3.2 Methods in Microbiology and Infection Biology

In the lecture, basic methods of molecular biology, biochemistry and microbiology are taught. These methods are then consolidated in exercises where the practical implementation of the methods is planned, and potential sources of error are analyzed. In the lab practical, the basic methods are carried out independently. In addition, students can choose between different advanced methods which are demonstrated in the working groups specialized in these methods.

Study aims

Students will

- get familiar with important molecular biology, biochemistry and microbiology methods and can conduct them independently while analysing potential errors.
- get familiar with the basics of good scientific work and are able to work in a team.

MIB-002	**Methods in Microbiology and Infection Biology**		
Category	compulsory		
ECTS Credits	15		
Workload	450 h	attendance: 180 h (12 class hours)	private study: 270 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture, exercises, lab practical		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** regular attendance, successful execution of all exercises **Assessment:** written exam		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Stegmann, E.		

2.3.3 Spotlights on Current Research Topics

In the lecture, students get a glimpse of the research being conducted and current topics being discussed in the different working groups in the field of microbiology at Tübingen. The joint weekend seminar is held together with students of the Master of Science "Cellular and Immunological Bioscience".

Study aims

Students will

- acquire theoretical and practical knowledge aboout various advanced topics in microbiology.

MIB-003	**Spotlights on Current Research Topics**		
Category	compulsory		
ECTS Credits	3		
Workload	90 h	attendance: 30 h (2 class hours)	private study: 60 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture, seminar		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** regular attendance of all lectures, active participation in the seminar **Assessment:** none		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Maier, L.		

2.3.4 Advanced Elective module

Topics in advanced microbiology elected by the students are taught. Detailed contents can be taken from the descriptions of the respective courses.

Study aims

Students will

- acquire theoretical and practical knowledge about various advanced topics in microbiology.

MIBs-004	**Advanced Elective module**		
Category	compulsory		
ECTS Credits	12		
Workload	360 h	attendance: 120 h (8 class hours)	private study: 240 h
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Lecture, seminar, practical, excursion		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** depending on the selected courses **Assessment:** none		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Brötz-Oesterhelt, H.		

2.3.5 Quantitative and Computational Biology

Courses offered within this module will teach and deepen selected topics from and relevant to the computational life sciences. Individual courses focus on sequence bioinformatics, structural bioinformatics, integrative bioinformatics, systems biology, data handling and analysis, statistics, or other relevant topics in the area of computational biology and bioinformatics. The focus of accompanying tutorials is to learn to implement algorithms of theoretical models and to analyze large life science data sets.

Study aims

Students will

- acquire theoretical knowledge, algorithmic and practical skills about computational biology concepts and methods that enable them to abstract and to model selected problems in the life science domain and to solve them in a data-driven way
- become familiar with implementing programs or writing scripts.

MIB-005	**Quantitative and Computational Biology**		
Category	compulsory		
ECTS Credits	6		
Workload	180 h	attendance: 60 h (4 class hours)	private study: 120 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture, tutorial, practical course		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** regular attendance of all lectures, active participation in the tutorial and practical, depending on the selected courses **Assessment:** written exam		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Ziemert, N.		

2.3.6 Scientific communication

Students strengthen their scientific communication skills with a focus on writing skills in preparation for their master's thesis. The structure, content, and style of the scientific manuscripts are addressed. Core concepts are taught using a combination of lectures, small-group exercises, and written essays, for which students receive extensive personalized feedback. In the journal club, primary scientific articles are discussed.

Study aims

Students will

- understand the scientific language in English and learn to evaluate results presented in publications.
- learn specific key skills that are acquired include recognizing the essential components and writing particularities of each section of a primary research article (abstract, introduction, methods, results, discussion), effectively writing scientific texts (paraphrasing, flow, grammatical specificities, etc.), designing clear and informative figures, appropriately referencing scientific literature (in-text and bibliography), and critically analysing and discussing primary scientific articles in a group setting.

MIB-006	**Scientific communication**		
Category	compulsory		
ECTS Credits	6		
Workload	180 h	attendance: 60 h (4 class hours)	private study: 120 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture, seminar, excersises		
Requirements	none		
Assessment and grading	**Non-assessed coursework:** regular attendance of all lectures, active participation in the seminar and exercises **Assessment:** written essays		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Wagner, S.		

2.3.7 Research Module 1

Students learn how to work independently on a scientific project in a working group. The students learn to design, implement and evaluate experiments in preparation for their Master´s thesis. The students present the progress and background of their experimental work in a scientific poster.

Study aims

Students will

- be able to independently develop experimental protocols based on scientific literature, to implement experiments in practice and to critically analyse the results.
- be able to write a scientific protocol and present the results orally.

MIB-007	**Research Module 1**		
Category	compulsory		
ECTS Credits	12		
Workload	360 h	attendance: 30 h (2 class hours)	private study: 330 h (independent lab work)
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Lab practical, seminar		
Requirements	Fundamentals of Microbiology and Infection Biology, Methods in Microbiology and Infection Biology		
Assessment and grading	**Non-assessed coursework:** exposé and succesful execution of a mini project **Assessment:** poster design and presentation		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Supervisor of the respective laboratory		

2.3.8 Research Module 2

Students learn how to work independently on a scientific project in a working group. The students learn to design, carry out and evaluate experiments as preparation for their master´s thesis. Students will prepare a protocol and report on the progress and background of their experimental work in an oral presentation.

Study aims

Students will

- be able to independently develop experimental protocols based on scientific literature, to implement experiments in practice and to critically analyse the results.
- be able to write a scientific protocol and present the results orally.

MIB-008	**Research Module 2**		
Category	compulsory		
ECTS Credits	12		
Workload	360 h	attendance: 30 h (2 class hours)	private study: 330 h (independent lab work)
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Lab practical, seminar		
Requirements	Fundamentals of Microbiology and Infection Biology, Methods in Microbiology and Infection Biology		
Assessment and grading	**Non-assessed coursework:** exposé and succesful execution of a mini project **Assessment:** wirtten or oral exam		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Supervisor of the respective laboratory		

2.3.9 Master's thesis

In the thesis, the students work independently on a research project. They acquire new data, exploit and interpret their results, design clear and informative figures and write a clear and concise thesis. The results should contribute to the gain of knowledge of the scientific community. Further, student's are required to participate in lab meeting/progress report.

Study aims

Within the Master's thesis students will show that they

- can acquaint themselves with complex scientific questions in a given time and are able to make suggestions to solve scientific problems.
- they are able to find and apply suitable methods to answer scientific questions
- they are able to work in a team in an international scientific environment and participate in lab meetings/progress report
- they are able to present their results to an international scientific community
- they are able to write clear and concise research texts

MIB-100	**Master's thesis**		
Category	compulsory		
ECTS Credits	30		
Workload	900 h	attendance: 30 h (2 class hours)	private study: 870 h (independent lab work and writing)
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Final thesis, progress report		
Requirements	Research Module 1 or 2		
Assessment and grading	**Non-assessed coursework:** oral presentation of results **Assessment:** written thesis		
Usability	Master of Science Microbiology and Infection Biology		
Module coordination	Supervisor of the thesis		

2.4 Required elective modules

With the *required elective modules* the following general rules apply:

1. At maximum 12 ECTS may be ungraded.
2. Only courses from the course catalogue of the University of Tübingen, or foreign universities in the context of an official semester abroad (e.g. via Erasmus) can be credited.
3. External courses such as internships in external laboratories, companies etc. **can not** be credited.
4. Modules already listed in the B.Sc. transcript **can not** be credited.
5. Up to 30 additional ECTS can be listed in the transcript of records. They will **not** affect the final grade, though.

2.5 Interdisciplinary Study Area (12 CP)

In this field of study, students can extend their studies in the direction of other disciplines to round off their chosen fields of work. Students can choose any course offered by University of Tübingen. Details on the contents of the courses and modules can be found in the module handbook of the respective degree programme and on alma. The grades will not be included in the final grade.

3 Contact & Information

General Information about the programme

Website of *Master in Microbiology and Infection Biology* programme

Application

Online via the Alma portal of the Universität. Application deadline: 15th July.

Study coordinator

Dr. Lisa Bleul

Academic adivsory service

Dr. Matthias Stoll, Studiendekanat

Transcript, Certification

Examinations office, Biology

Enrolling/Changing of the subject, granting of a leave

Student administration

Informal information about studying biology, help and hints

Study body of the department of Biology: www.fsbiotuebingen.de