EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Module Handbook

Cellular and Immunological Biosciences
Master of Science



Valid from Winter Term 2024/25

Faculty of Sciences
Department of Biology
Institute of Cell Biology & Center for Plant Molecular Biology

06.11.2026

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1. Program Overview

The Master of Science degree program “Cellular and Immunological Biosciences – from single cells to plants, animals, and humans” provides practice-oriented knowledge and highly specialised skills for researching complex cellular and immunological processes in a wide range of model systems, ranging from single cells to plants, animals and human cells and tissues.

This master’s program focuses on understanding the molecular mechanisms that regulate the function and behaviour of cells during development, homeostasis, and in disease. This includes, for example, disease-related functional disorders, such as those occurring in immunodeficiencies or in connection with tumour immunology, cellular responses to pathogen invasion, the activation of various immune systems, and mechanisms that govern developmental processes. The comparative aspects of cell biological, developmental, and immunological processes in human cells and in various model organisms, such as *Saccharomyces*, *Drosophila*, and *Arabidopsis,* are the stand-out feature of this study program.

The CIB Master’s program provides a broad academic education that equips graduates for a wide range of career opportunities, particularly research-related positions in academic and non-academic institutions specialising in cell biology, molecular biology, and in immunology. It also lays the foundations for subsequent doctoral study (see Chapter 4).

Admission requirements

For admission to the M.Sc. program in Cellular and Immunological Biosciences (MSc CIB), a B.Sc. degree in biology with a grade of 2.50 or better (German grading scheme) is required. The application requires a proof of English language proficiency at level B2 and a proof of German language proficiency at level A2 (Common European Framework of Reference for Languages). Further details can be found on the website of the MSc CIB program.

All compulsory classes are taught in English. Students can choose courses taught in German as part of the Interdisciplinary Study Area (see Chapter 3.10.).

Successful graduates will:

- have a thorough knowledge and understanding of principles and methods in life sciences and of theoretical approaches, with a focus on cell biology, molecular biology, and immunology.
- be familiar with the current state of research and be able to question it. The in-depth knowledge gained in the different research areas enables graduates to develop their own scientific ideas and projects and to devise approaches that answer their questions.
- be capable of estimating the relevance and effects of their own professional practice considering scientific and ethical principles.
- be able to present, elucidate, and discuss the results of their research in front of a scientific audience in English, both in oral and in written form.
- have evolved their transferable skills including analytical skills, critical thinking, time management, team work and communication skills.

2. Curriculum

The MSc CIB program is split into different *modules* that convey competences to work successfully in modern life science research. Some of these modules are *compulsory* while others are *elective*. Each module has a certain weight given in ECTS credit points (CPs). The amount of CPs per module depends on contact hours and time spent into individual self-reliant course work. One CP equals a workload of about 30 hours (contact hours + self-reliant work + preparations for the exam). Each year of studies usually yields 60 credit points. Module details can be found in the electronic course catalogue alma. A general description is following below (Chapter 3.).

2.1. Overview by Modules

Module number	c = compulsory / e = elective	Module name	Recommended semester	CPs
CIB-001	c	Fundamentals of Cellular and Immunological Biosciences	1	12
CIB-002	c	Methods in Cellular and Immunological Biosciences	1	15
CIB-003	c	Spotlights on Current Research Topics	1	3
CIB-004	c	Advanced Elective Module	2	12
CIB-005	c	Quantitative and Computational Biology	2	6
CIB-006	c	Scientific Communication	3	6
CIB-007	c	Research Module 1	3	12
CIB-008	c	Research Module 2	3	12
	e	Interdisciplinary Study Area	2	12
CIB-100	c	Master's thesis[1]	4	30
			total[2]	120

[1] The topic must be cellular, molecular, and/or immunological biology related and at least 60 CPs must be achieved before candidates can be admitted to the master's thesis (see 2.3.9.).

[2] Up to 30 additional credits can be listed in the transcript but will not affect the final grade.

2.2. Overview by Semesters

The overview below shows a typical course of study. Students choose - according to their interests - the topics of courses of the Advanced Elective Module, the Interdisciplinary Study Area, the Research Modules (RM1 + RM2), and of the Master thesis[3]. Thus, depending on the selected courses, the specific course organisation might look differently for each student.

Semester	Total CP	Module number	c = compulsory / e = elective	Module name	CPs
1	30	CIB-001	c	Fundamentals of Cellular and Immunological Biosciences	12
		CIB-002	c	Methods in Cellular and Immunological Biosciences	15
		CIB-003	c	Spotlights on Current Research Topics	3
					30
2	30	CIB-004	c	Advanced Elective Module	12
		CIB-005	c	Quantitative and Computational Biology	6
			e	Interdisciplinary Study Area	12
					60
3	30	CIB-007	c	Research Module 1	12
		CIB-008	c	Research Module 2	12
		CIB-006	c	Scientific Communication	6
					90
4	30	CIB-100	c	Master's thesis[3]	30
				total[4]	120

[3]The topic must be cellular, molecular and/or immunological biology related and at least 60 CPs must be achieved before candidates can be admitted to the master's thesis (see 2.3.9).

[4]Up to 30 additional credits can be listed in the transcript but will not affect the final grade.

3. Description of Modules

3.1. Fundamentals of Cellular and Immunological Biosciences

This module teaches advanced cell biological and immunological principles, including genome structure and organization, gene expression, protein structure and function, cell structure and compartmentalization, membrane trafficking, metabolism, communication and signalling, cell growth, division and reproduction, immunity, and infection.

Study aims

Students

- acquire knowledge of advanced principles in the fields of molecular cell biology and immunology.
- are able to link various specialist areas and paradigms of molecular cell biology and immunology.
- are actively involved in seminars and tutorials and acquire the competence to process information from original publications.

CIB-001	**Fundamentals of Cellular and Immunological Biosciences**		
Category	Compulsory		
ECTS Credits	12		
Workload	360 h	Attendance: 120 h (8 credit hours)	Private study: 240 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture (4h/week), Tutorial(2h/week), Exercise (2h/week)		
Requirements	None		
Assessment and grading	Lecture with **graded assessment:** written exam Tutorial with **non-graded coursework:** attendance, presentation Exercise with **non-graded coursework:** attendance, presentation		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Proikas-Cezanne, T.		

3.2. Methods in Cellular and Immunological Biosciences

The lecture "Methods in Cellular and Immunological Biosciences" covers principles of key methods in cell biology, biochemistry, immunology, and molecular biology.

In the practical exercises "Methods in Cellular and Immunological Biosciences", students gain hands-on experience with selected methods from cell biology, biochemistry, immunology, and molecular biology, and discuss how these methods can be applied to research questions.

The practical course "Advanced Methods in Cellular and Immunological Biosciences" covers selected advanced methods of cell biology, biochemistry, immunology, and molecular biology.

Study aims

Students

- get familiar – hands on – with important molecular and cellular biology, biochemistry, and immunology methods and can conduct them independently.
- critically evaluate methods and analyse potential errors.
- train skills in good scientific work, in choosing appropriate methods, and working in teams.

CIB-002	**Methods in Cellular and Immunological Biosciences**		
Category	compulsory		
ECTS Credits	15		
Workload	450 h	Attendance: 180 h (12 credit hours)	Private study: 270 h
Duration	1 term		
Cycle of offer	Each winter term		
Language	English		
Format	Lecture (4h/week) Practical Course (6h/week) Advanced Practical Course (2h/week)		
Requirements	None		
Assessment and grading	Lecture with **graded assessment:** written exam Practical Course with **non-graded coursework:** attendance, exercises Advanced Practical Course with **non-graded coursework:** attendance		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Stahl, M. El-Kasmi, F.		

3.3. Spotlights on Current Research Topics

Introductory lectures on current areas of research in molecular cell biology, immunology, developmental biology, and genetics, with two speakers per lecture and per week (max 15 dates): various working groups from the participating institutes (ZMBP, IZB) as well as guest lecturers present their fields of research, specific research topics, and their particular methodologies.

Study aims

Students

- get to know the different working groups.
- get an insight into the ongoing research.
- get a decision-making support for choosing their elective courses and research modules.
- familiarise themselves with the various projects being carried out by research groups of the participating institutes in the fields of molecular, cell, and developmental biology, as well as immunology.
- start building a network with their peers and with scientists of the participating institutes.

CIB-003	**Spotlights on Current Research Topics**		
Category	Compulsory		
ECTS Credits	3		
Workload	90 h	Attendance: 30 h (2 credit 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-graded coursework:** regular attendance and active participation **Graded assessment:** none		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Timmermans, M.		

3.4. Advanced Elective Module

The students can select different courses focused on a particular current research topic: each course teaches advanced concepts and methodology of modern cell biological and immunological research using a combination of either lecture and practical, lecture and seminar or seminar and practical. Courses offered include: Stem Cell Niches of Plants, Principles of Forward Genetics, Comparative Immunity of Plants, Animals, and Bacteria, Cell Biology of Health and Disease, Principles of Immunology, Bacteria-Host-Interactions, and others.

Study aims

Students

- apply and expand their knowledge on state-of-the-art methodology and research question currently pursued.
- strengthen their ability to independently develop research goals, design experiments, and postulate hypothesis.
- expand their portfolio of methods and approaches.

CIB-004	**Advanced elective module**		
Category	Compulsory		
ECTS Credits	12		
Workload	360 h	Attendance: 120 h (8 credit hours)	Private study: 240 h
Duration	1 term or block courses (depending on selected courses)		
Cycle of offer	Each term		
Language	English		
Format	Lecture, seminar, practical (depending on the selected course) 3 CP courses (2h/week or ~ 28h block) 6 CP courses (4h/week or 4 week block)		
Requirements	None		
Assessment and grading	**Non-graded coursework** (depending on the selected course)**:** regular attendance, active participation, successful completed exercises, practical lab work, protocols, and/or presentations **Graded assessment:** none / not included		
Usability	Master of Science Cellular and Molecular Biosciences		
Module coordination	Wolf, S.		

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 accompanying tutorials focus on learning to implement algorithms of theoretical models and to analyse large life science data sets.

Study aims

Students

- acquire theoretical knowledge, algorithmic skills, and practical skills in 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.

CIB-005	**Quantitative and Computational Biology**		
Category	Compulsory		
ECTS Credits	6		
Workload	180 h	attendance: 60 h (4 credit hours)	Private study: 120 h
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Lecture (2h/week) Exercise (2h/week)		
Requirements	None		
Assessment and grading	**Non-graded coursework:** regular attendance, successful completed exercises, and active participation, depending on the selected courses **Graded assessment:** written exam		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Harter, K.		

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 scientific manuscripts are addressed. Core concepts are taught using a combination of lectures, small-group exercises, and written essays, for which students receive extensive personalised feedback.

Study aims

Students

- learn strategies for refining research questions and structuring the results section in a logical and rigorous manner in line with the research question(s).
- are familiar with the structural and stylistic conventions of scientific manuscripts and know how to apply these in their own writing.
- learn techniques for writing academic texts effectively, creating clear and informative illustrations, and citing academic literature correctly (in the text and in the reference list).
- are able to adapt their communication to improve the conveyance of academic content in various situations (articles, posters, lectures, chalk talks, conference dinners, elevators).

CIB-006	**Scientific communication**		
Category	Compulsory		
ECTS Credits	6		
Workload	180 h	Attendance: 60 h (4 credit hours)	Private study: 120 h
Duration	1 term		
Cycle of offer	Each term		
Language	English		
Format	Lecture, seminar, exercises		
Requirements	None		
Assessment and grading	**Non-graded coursework:** regular attendance of all lectures, successful completed exercises, active participation **Grade assessment:** assignments		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Coordinator of the program		

3.7. Research Module 1

Through this module, students acquire hands-on experience in current research through the development of a small project in a laboratory of their choice, putting into practice the theoretical knowledge from other courses of the MSc's program. The students learn to design and carry out experiments and evaluate the results as preparation for their master's thesis. During this time, they will become full members of the research group and participate in all group activities, e.g. lab meetings.

Study aims

Students

- learn and apply scientific methodology and acquire experience in experimental design and interpretation, while familiarizing themselves with work in a research laboratory.
- are able to independently develop experimental protocols based on scientific literature, to implement experiments in practice, and to critically analyse the results.
- are able to document and present their results.
- exercise their communication skills by preparing and presenting a scientific poster of their results.

CIB-007	**Research Module 1**		
Category	Compulsory		
ECTS Credits	12		
Workload	360 h	Attendance: 30 h (2 credit hours)	Private study: 330 h (independent lab work)
Duration	8 weeks (full-time)		
Cycle of offer	Each term		
Language	English		
Format	Lab practical, seminar		
Requirements	Fundamentals of Cellular and Immunological Biosciences, Methods in Cellular and Immunological Biosciences		
Assessment and grading	**Non-graded coursework:** exposé and successful execution of a mini project **Graded assessment:** poster design and presentation		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Lozano-Durán, R.		

3.8. Research Module 2

Through this module, students acquire hands-on experience in current research through the development of a mini project in a laboratory of their choice, putting into practice the theoretical knowledge from other courses of the MSc's program. The students learn to design and carry out experiments and evaluate the results as preparation for their master's thesis. During this time, they will become full members of the research group and participate in all group activities, e.g. lab meetings.

Study aims

Students

- learn and apply scientific methodology and acquire experience in experimental design and interpretation, while familiarizing themselves with work in a research laboratory.
- are able to develop independently experimental protocols based on scientific literature, to implement experiments in practice and to critically analyse the results.
- are able to document and present their results.
- exercise their communication skills through a final presentation of their work in form of a scientific talk or a written protocol.

CIB-008	**Research Module 2**		
Category	Compulsory		
ECTS Credits	12		
Workload	360 h	Attendance: 30 h (2 credit hours)	Private study: 330 h (independent lab work)
Duration	8 weeks (full-time)		
Cycle of offer	Each term		
Language	English		
Format	Lab practical, seminar		
Requirements	Fundamentals of Cellular and Immunological Biosciences, Methods in Cellular and Immunological Biosciences		
Assessment and grading	**Non-graded coursework:** exposé and successful execution of a mini project **Graded assessment:** written or oral exam		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Lozano-Durán, R.		

3.9. Master's thesis

For their Master's thesis, 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 increase the knowledge of the scientific community. Furthermore, students participate in lab meetings and give progress reports.

Study aims

With the Master's thesis, students show that

- they are able to familiarise themselves with complex scientific questions within a specified timeframe and put forward proposals for solving 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, e.g. by giving progress reports.
- they are able to present their results to an (international) scientific community.
- they are able to write clear and concise research texts.

CIB-100	**Master's thesis**		
Category	Compulsory		
ECTS Credits	30		
Workload	900 h	Attendance: 30 h (2 credit hours)	Private study: 870 h (independent lab work and writing)
Duration	6 months		
Cycle of offer	Each term		
Language	English		
Format	Final thesis, progress report		
Requirements	Fundamentals of Cellular and Immunological Biosciences, Methods in Cellular and Immunological Biosciences, Quantitative and Computational Biology		
Assessment and grading	**Non-graded coursework:** oral presentation of results **Graded assessment:** written thesis		
Usability	Master of Science Cellular and Immunological Biosciences		
Module coordination	Supervisor of the thesis		

3.10. Interdisciplinary Study Area

In this study area, students add 12 CPs to their MSc CIB program. To do so, students may choose any courses offered by the University of Tübingen, such as further courses from the 'Advanced Elective Module' (CIB-006) or courses on other topics, both within and outside the field of biology. Details on the contents of the courses are listed on alma. The conditions set out in section 3.11. apply to these elective courses. Grades from selected courses will not be included in the final grade of the MSc CIB degree.

3.11. Elective Courses

For *elective courses* – e.g. the ones selected for the Interdisciplinary Study Area (see 3.10.) or additional courses (see below) – the following general rules apply:

- 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 or CIVIS) can be credited.
- Courses already listed in the B.Sc. transcript cannot be credited.
- Up to 30 additional CPs can be listed on the transcript of records. Grades from selected courses will not be included in the final grade of the MSc CIB degree.

4. Career Perspectives

Graduates of the MSc CIB program have a broad and research-centred professional profile with a thorough knowledge of cellular and immunological processes and hands-on experiences in advanced molecular, cell biological, and immunological methods using different model systems.

During their study program, graduates acquire a variety of "hard skills": e.g. numerous research techniques, computer skills, data analysis skills, writing proficiency, and - last but not least - a M.Sc. degree.

In addition, graduates develop a variety of transferable skills ("soft skills"): analytical skills and problem solving, creativity and critical thinking, time management and prioritisation, team work and collaboration, communication and networking skills, adaptability and leadership skills.

Career options include postgraduate studies (PhD), research and administrative positions at healthcare institutions as well as in companies of the biotech, pharma, or the agriculture sector, and positions focusing on scientific writing and science communication.

5. Inclusion

The study program MSc CIB aims to foster each student's talents. To ensure a successful start into the program as well as a successful performance during the program, the University of Tübingen, the Department of Biology, and the MSc CIB program offer support at different levels. This includes for example a buddy program for national and international newcomers and networking activities for women in life sciences. For more information contact the coordinator and the webpages of the University of Tübingen (see Chapter 6. for a selection of links).

6. Contact & Information (Links)

6.1. MSc CIB Program

General Information about the MSc CIB program is given on its website.

6.2. Application

- Online via the alma portal of the Universität
- Information about requirements
- Application deadline: **May 31**

6.3. Contacts

Study coordinators
Dr. Sven Hülsmann, Dr. Farid El-Kasmi

Academic advisory service
Dr. Matthias Stoll, Office of Academic Affairs Biology

Transcript, Certification
Examination Office Biology

Enrolling/Changing of the subject, granting of a leave
Student Administration

6.4. Information & Support MSc Studies

Information from peers, about studying biology, help, and hints
Student Council of the Department of Biology

Support during studying
Career Development
Advice on Mental Health
Support for students with disability or (chronic) illness

Studying abroad / Erasmus / CIVIS
Studying Abroad
Erasmus Program Biology
CIVIS