LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Module Catalogue

Master's Programme: Biochemistry (Master of Science, M.Sc.)

(120 ECTS credits)

Based on the *Prüfungs- und Studienordnung* of 1 January 2015

88/025/---/M0/H/2015

Issued on 18 March 2016

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Abbrevations and annotations

CP	Credit Points, ECTS credits
ECTS	European Credit Transfer and Accumulation System
h	hours
SoSe	summer semester
SWS	contact hours
WiSe	winter semester
WP	compulsory elective Module / course
P	mandatory Module / course

1. The ECTS credits assigned in the Module Catalogue are designated as follows: Credit Points not listed in parentheses are awarded when the pertinent examination of the Module or Module parts have/has been completed successfully. Credit Points in parentheses are listed for calculatory purposes only.

2. The semester for taking a Module can either be binding or may be considered as a recommendation, depending on the applicable data in Anlage 2 of the *Prüfungs- und Studienordnung* for your Programme. In this Module catalogue, the options are indicated as "scheduled semester" and "recommended semester".

3. Please note: The Module Catalogue is merely intended to serve as an orientation whereas the provisions of the applicable version of the *Prüfungs- und Studienordnung* (in German only) of your Programme are legally binding. See: www.lmu.de/studienangebot and select your Programme.

Module: P 1 Main Topic Biochemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	P 1.1 Advanced Research Practical course in Biochemistry	WiSe and SoSe	240 h (16 SWS)	120 h	(12)
Seminar	P 1.2 Advanced Seminar in Biochemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Mandatory module with mandatory courses
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group from the field of Biochemistry. Directly supervised by a professional scientist students get involved in an ongoing research project. During this **practical part** they learn and apply modern biochemical techniques, which comprise state of the art biochemical methods used in the day-to-day research of the lab. Thereby the students complement and deepen their methodical skills and theoretical knowledge. Students plan and execute scientific experiments independently. In the accompanying **seminar** students extend their expertise of the research topic, they present and discuss their own research results in the group.
Learning outcomes	Students acquire competence to work in an actual research lab on an ongoing project. They acquire the expertise to do independent, target-oriented literature search followed by transfer of theoretical knowledge to practical applications. Students will be competent in planning and execution of complex biochemical experimental set-ups and can recognize and estimate related security questions when handling hazardous material. They gain the expertise of independent decision making and critical interpretation/evaluation of experimental data. Students acquire experience

	competence in presentation and discussion of their research data with other scientists.
Type of examination	Scientific report
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Roland Beckmann
Language(s)	English

Module: P 2 Main Topic Biochemistry I

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 2.1 Life cycle of Proteins	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	P 2.2 Flow of genetic Information	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	P 2.3 Model Organisms	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Mandatory module with mandatory courses
Usability of the module in other Programmes	Master in Chemistry Master in Bioinformatics
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	The module broadens and deepens special professional knowledge from the field of Biochemistry. The lectures cover central aspects in the cellular biochemistry and life cycle of proteins, key processes in genome biology and the most important model organisms used in current modern research.
Learning outcomes	The lectures are based on current reserach topics in Biochemistry with new research results continuously updated. The lecture will enable students to understand modern Biochemistry research towards primary literature and review article level and to broaden and deepen their already acquired knowledge. They will understand and learn to judge selected literature experiments to test research hyotheses with current topics in Biochemistry. The acquired theoretical knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.

Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Karl-Peter Hopfner
Language(s)	English

Module: P 3 Fundamentals in Data Analysis

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	P 3.1 Practical Bioinformatics	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)
Exercise course	P 3.2 Tutorial in practical Bioinformatics	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)
Lecture	P 3.3 Statistics and Data analysis	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)
Exercise course	P 3.3 Tutorial Statistics and Data analysis	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 1 semester.
Content	This module provides foundational quantitative skills essential for mastering modern techniques in structural biology and functional genomics. The module covers a comprehensive refresher on fundamental concepts in mathematics and provides a course on fundamental statistics. Building on this foundation, students will explore more advanced methods in applied statistics and data mining, as well as their practical applications to biological datasets. Participants will further gain hands-on experience with programming to implement the learned content in tutorials and exercises.
Learning outcomes	By the end of this module, students will have developed critical thinking when it comes to analyzing and interpreting quantitative data. They will have strengthened their quantitative reasoning and will have learned to apply concepts of statistics and data mining to critically evaluate research data, and confidently

	integrate interdisciplinary approaches into their experimental workflows.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Johannes Stigler
Language(s)	English

Module: WP 1 Extension Topic Lecture Moleculare Systems biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 1.1 Lecture on Moleculare Systems biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	Basic High Throughput Sequencing (HTS) concepts, Example applications in cancer and other diseases, Data generation, Computer basics, Data formats, General analysis tools, Alignment and mapping tools, RNA sequencing, DNA sequencing & variant calling, Epigenome sequencing, Single-cell sequencing, and Spatio-molecular profiling
Learning outcomes	After attending this lecture students will be able to (1) name, characterize and compare different HTS technologies, protocols, and data types, (2) recognize and discuss problems and solutions around the storage and distribution of HTS data, (3) recognize HTS data types and identify adequate analytical tools and approaches, (4) apply basic algorithmic and statistical concepts in the context of HTS data analysis, (5) describe core analytical concepts and find suitable tools related to different HTS data types, (6) interpret raw and processed HTS data, and (7) describe medical and research-related use-cases of HTS approaches.
Type of examination	Written exam

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Johanna Klughammer
Language(s)	English

Module: WP 2 Extension Topic Lecture Structural biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 2.1 Lecture in Structural biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 1 semester.
Content	This lecture covers the basic principles of macromolecular crystallography (MX), small-angle X-ray scattering (SAXS) and cryo electron microscopy (cryo-EM) for their application in structural biology. The MX-part covers fundamental principles of macromolecular crystallization, X-ray diffraction, data collection and processing, including phase determination and model building/refinement. The SAXS method is further introduced as a complementary method for the analysis of molecules in solution, especially useful for flexible assemblies. The following parts of the lecture cover the fundamental knowledge and necessary steps to perform single-particle cryo electron microscopy, followed by its extension to cryo electron tomography.
Learning outcomes	Students will acquire knowledge of key concepts in structural biology. They should be able to describe and explain the principal steps of solving high-resolution macromolecular structures with MX and cryo-EM, and understand the concepts and information content of solution scattering. Based on the methodologies acquired in the course the students will be able to understand the

	necessary steps of structural methods and critically compare the advantages of the individual methods to be able to transfer this knowledge to their applicability to new questions.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Beckmann, Prof. Hopfner
Language(s)	English

Module: WP 3 Extension Topic Lectures Molecular and Cellular Genetics

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 3.1 Posttranscriptional Generegulation	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 3.2 Genetics of Cancer and Aging	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	The module introduces special knowledge from the field of Molecular and Cellular Genetics. The lectures cover genetic mechanisms underlying complex cellular processes and the multiple levels of regulation of gene expression before and after transcription comprising topics such as cancer, aging and cellular quality control.
Learning outcomes	Students gain an expertise in up-to-date topics of current research in Molecular and Cellular Genetics. They acquire knowledge and competence to understand and evaluate special topics about regulation of gene expression and about genetic mechanisms controlling complex cellular processes such as cancer, aging and cellular quality control. New specialized information is integrated in existing knowledge to gain the capacity to formulate and discuss related scientific problems. The acquired theoretical knowledge is further implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Beckmann
Language(s)	English

Module: WP 4 Extension Topic Genetics

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 4.1 Lecture Fundamentals in Genetics	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 4.2 Advanced Lecture in Genetics	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Genetics. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in GEnetics and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Genetics and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.

Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	
Language(s)	English

Module: WP 5 Extension Topic Human Biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 5.1 Fundamentals in Human Biology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 5.2 Advanced Lecture in Human Biology	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Human Biology. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in Human Biology and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Human Biology and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Leonhardt, Prof. Meilinger
Language(s)	English

Module: WP 6 Extension Topic Moleculare Plant Sciences

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 6.1 Basics of Moleculare Plant Sciences	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 6.2 Advanced lecture in Moleculare Plant Sciences	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Moleculare Plant Sciences. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in Moleculare Plant Sciences and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Moleculare Plant Sciences and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Leister, Prof. Nickelsen
Language(s)	English

Module: WP 7 Extension Topic Immunology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 7.1 Lecture on Immunology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 7.2 Advanced Topics of Immunology	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	This module teaches professional knowledge in the field of immunology and fundamental principles of how the innate immune system works. The lectures cover the sensing of non-self, the connection of the innate and the adaptive immune responses, as well as defense mechanisms against pathogens in context with the aberrant activation of inflammation.
Learning outcomes	Students gain profound knowledge in basic principles in Immunology and are introduced to the state-of-the-art research in Immunology. Previously acquired knowledge is expanded, deepened and applied to formulate and discuss scientific concepts and problems in the context of Immunology. The obtained theoretical expertise will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.

Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Hornung
Language(s)	English

Module: WP 8 Main Topic Cell biology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 8.1 Advanced seminar in Cell biology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical laboratory course	WP 8.2 Advanced research practical course in Cell biology	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group from the field of Cell Biology. Supervised by a professional scientist students get involved in a current research project. During the practical course they apply modern techniques and deepen their methodical skills and theoretical knowledge. Students learn to plan and execute scientific experiments independently. At the accompanying seminar students extend their expertise of the research topic and present and discuss their own research results.
Learning outcomes	Students acquire expertise for work in research: - independent, target-oriented literature search - transfer of theoretical knowledge to practical applications - planning and execution of complex experimental set-ups - recognition and estimation of security questions while handling hazardous material -decision making and critical interpretation and evaluation of experimental data

	- appraisal, presentation and discussion of research data and results
Type of examination	Practical course report and presentation
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	PD Dr. Mokranjac
Language(s)	English

Module: WP 9 Main Topic Microbiology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 9.1 Advanced Seminar in Microbiology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical laboratory course	WP 9.2 Advanced Research Practical course in Microbiology	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	Students work in a research group from the field of Microbiology. Supervised by a professional scientist students get involved in a current research project. During the practical course they apply modern techniques and deepen their methodical skills and theoretical knowledge. Students learn to plan and execute scientific experiments independently. At the accompanying seminar students extend their expertise of the research topic and present and discuss their own research results.
Learning outcomes	Students acquire expertise for work in research: - independent, target-oriented literature search - transfer of theoretical knowledge to practical applications - planning and execution of complex experimental set-ups - recognition and estimation of security questions while handling hazardous material - decision making and critical interpretation and evaluation

	of experimental data - appraisal, presentation and discussion of research data and results
Type of examination	Written report and assessment of the practical work.
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. K. Jung
Language(s)	English

Module: P 4 Main Topic Biochemistry II

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	P 4.1 Subject-specific seminar in Biochemistry	SoSe	30 h (2 SWS)	60 h	(3)
Colloquium	P 4.2 Subject-specific colloquium in Biochemistry	WiSe und SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Mandatory module with mandatory courses
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 2 + 3
Duration	The completion of the module takes 2 semesters.
Content	P4.1: The intention is to work actively with primary research publications and to pursue independent literature research. Assignments are chosen around a focus topic, thus in-depth knowledge on a particular scientific subject is also acquired. P4.2: External speakers present their research, followed by a short discussion in the lecture hall. The speakers typically give particular attention to thoroughly introduce their topic to an audience that also comprises non-experts. In addition, ongoing research projects from research teams at the local institutes are presented, again with a focus on the somewhat heterogeneous audience during the introduction.
Learning outcomes	P4.1: Students will search, read, understand and summarize original scientific publications. They can evaluate the importance of the published results in the context of other, related publications and actively discuss the relative merits with other course participants. If appropriate, they can place the scientific achievements in the context of past, current or future societal challenges and evaluate whether deployment of novel techniques beyond the lab should be considered. Students first conceive and then present their introduction into the topic, the summary of the

	publication and an evaluation of its merits orally, thus perfecting their presentation skills as well as the ability to meet deadlines. P4.2: Students will acquire broad knowledge of current biochemical research topics. Furthermore, they will experience different styles and strategies to present research. They are able to latch onto the presented trains of thought rapidly and practice to stay focused until the end of the talk.
Type of examination	Presentation or scientific report
Type of assessment	The successful completion of the module will not be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Julian Stingele, Prof. Klaus Förstemann
Language(s)	English

Module: P 5 Methods in Life sciences

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	P 5.1 Practical course in Life sciences	WiSe and SoSe	150 h (10 SWS)	75 h	(7,5)
Seminar	P 5.2 Advanced seminar in the Life sciences	WiSe and SoSe	15 h (1 SWS)	30 h	(1,5)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 11 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Mandatory module with mandatory courses
Elective guidelines	None
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	P5.1: Students join one of the research teams and pursue hands-on research according to the focus of the particular team. The goal is independent work with a sufficiently strong focus according to the available time. P5.2: Students participate in weekly meetings of the team, discuss ongoing research regularly and/or work through weekly assignments in the form of research publications.
Learning outcomes	P5.1: Students employ their advanced knowledge of biochemistry and data analysis / bioinformatics to independently conceive experiments and analysis strategies, then carry out the work independently. They document their achievements according to scientific standards, then summarize and discuss their results both in a written research protocol (ideally mimicking the style of a publication) as well as in one or several oral presentation(s). P5.2: Students will read, understand and summarize original scientific publications. They can evaluate the importance of the published results in the context of other, related publications and actively discuss the

	relative merits with other team members. Students first conceive and then present an introduction into the topic, summarize the publication and evaluate its merits, thus perfecting their presentation skills as well as their ability to meet deadlines.
Type of examination	Presentation and report on the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Julian Stingele, Prof. Klaus Förstemann
Language(s)	English

Module: WP 10 Extension Topic Advanced Topics in Moleculare Systems biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 10.1 Advanced Topics in Moleculare Systems biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 1
Duration	The completion of the module takes 2 semesters.
Content	Basic High Throughput Sequencing (HTS) concepts, Example applications in cancer and other diseases, Data generation, Computer basics, Data formats, General analysis tools, Alignment and mapping tools, RNA sequencing, DNA sequencing & variant calling, Epigenome sequencing, Single-cell sequencing, and Spatio-molecular profiling
Learning outcomes	After attending this lecture students will be able to (1) name, characterize and compare different HTS technologies, protocols, and data types, (2) recognize and discuss problems and solutions around the storage and distribution of HTS data, (3) recognize HTS data types and identify adequate analytical tools and approaches, (4) apply basic algorithmic and statistical concepts in the context of HTS data analysis, (5) describe core analytical concepts and find suitable tools related to different HTS data types, (6) interpret raw and processed HTS data, and (7) describe medical and research-related use-cases of HTS approaches.
Type of examination	Written exam

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Johanna Klughammer
Language(s)	English

Module: WP 11 Extension Topic Moleculare Systems biology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 11.1 Practical course in Moleculare Systems biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	Successful completion of module WP 1
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Part I High throughput sequencing (HTS): RNA sequencing data analysis. Galaxy and data acquisition, QC and pre-processing, Read mapping/alignment, Expression quantification, Differential gene expression, Visualization. Part II Mass spectrometry (MS): Analysis of different types of MS data. MaxQuant DDA, Perseus LFQ data cleaning and visualization, Perseus LFQ data analysis, Perseus interactions & networks, Post-translational modifications, Isobaric labeling, MaxQuant DIA
Learning outcomes	After completing this course students will be able to (1) find and use state-of-the art analysis tools (2) find, select and download data (3) create basic data analysis workflows (4) communicate problems using the appropriate technical terms (5) critically assess and discuss data and intermediate analysis steps, (6) write simple data analysis code, and (7) seek and provide help through internal and external digital communications channels.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Johanna Klughammer
Language(s)	English

Module: WP 12 Extension topic Advanced Topics in Structural biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (Mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 12.1 Advanced topics in Structural biology	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 3 ECTS credits have to be acquired. Class attendance averages about 2 contact hours. Including time for self-study, 90 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	This lecture extends concepts used in structural biology and their application. The course covers advanced principles of scattering and diffraction and in addition, knowledge of protein building blocks, protein folds and ribonucleic acid-protein complexes will be provided. Based on selected topics, the students will learn about the role and application of structural biology methods in more detail, e.g. in understanding biological processes on molecular basis or in the process of pharmaceutical drug discovery. The students will prepare own presentations based on selected publications in the field of structural biology. Each student is expected to give a broad introduction to the scientific focus of the respective publication, followed by a presentation of the findings with emphasis on a critical discussion of the methods, results, quality, and the discussion.
Learning outcomes	Students will acquire knowledge about advanced topics of three-dimensional macromolecular structure determination of proteins and nucleic acids, especially with respect to combinatorial/orthogonal methods and their individual

	advantages and disadvantages. The students will be able to present and critically discuss publications in the field of structural biology. Based on this knowledge and training, the students will be able to recognize the relevance of publications, which is important in their careers as structural biologists. In addition, the detailed in-depth analysis of structural biology publications will enable them to develop own approaches in future projects.
Type of examination	Written exam or presentation or scientific journal or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Beckmann, Prof Hopfner
Language(s)	English

Module: WP 13 Extension Topic Structural biology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 13.1 Practical course in Structural biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	Successful completion of module WP 2
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	This practical course covers the steps to be able to perform structural analysis of macromolecules using X-ray crystallography (MX) and single-particle cryo electron microscopy (cryo-EM). First, the students perform bioinformatic analysis to find the relationship of the protein's amino acid sequence to sequences of other organisms, and to predict functional domains. In addition, they will use *in silico* modeling (e.g. Alphafold) to generate structural models from their query sequences. In the MX-part the students learn and receive hands-on training in structure solution using X-ray diffraction data. The student will independently analyze exemplary diffraction data and perform all steps from data processing to phase determination, density modification and model/ligand building and refinement. During the cryo-EM part, the students will receive training in sample and grid-preparation followed by exemplary data collection at the cryo-electron microscope. The students will then process and

	evaluate single-particle datasets covering all steps from particle picking, 2D/3D classification etc. to then yield and interpret density maps which can be used to fit and refine a molecular model. Finally, the quality of the model is validated.
Learning outcomes	Students will acquire knowledge about the basic steps to solve macromolecular structures of proteins and nucleic acids by MX and cryo-EM. They will be able to describe and explain the principal steps of data processing, and structure determination and can use and transfer this knowledge to new problems. The students will be able to compare the two techniques to critically asses their usability on different potential targets. With the hands-on training in model building and model interpretation, the students will be able to interpret three-dimensional structural data of macromolecules in order to understand and explain central concepts of e.g. enzymatic processes or protein-ligand interactions. After the course, students will be able to independently apply structural biology methods and/or be able to critically address structural biology related results in literature.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Hopfner
Language(s)	English

Module: WP 14 Extension Topic Molecular and cellular Genetics – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 14.1 Practical course in Molecular and Cellular Genetics	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	The students carry out state-of-the-art biochemical and cell biological techniques such as RNAi in tissue culture cells, GFP-tagging of proteins by homologous recombination in eukaryotic cells, determination of their sub-cellular localization using fluorescence microscopy. They reconstitute macromolecular complexes in vitro and apply the CRISPR-Cas technology in cultured eukaryotic cells.
Learning outcomes	Students acquire practical expertise in the independent application and interpretation of modern biochemical and cell biological methods. They gain competence in the application of genetic methods, such as CRISPR-Cas gene editing, and are competent in performing, evaluating and interpreting experiments with quantitative read-out such as in vitro reconstitution of protein complexes and fluorescence microscopy.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Beckmann
Language(s)	English

Module: WP 15 Extension Topic Genetics – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 15.1 Practical course in Genetics	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group with expertise in the field of Genetics and get involved in a current research project. They are supervised by professional scientists thereby insuring that students learn to tackle an actual scientific project by using state-of-the-art techniques of the subject area. Theoretical knowledge acquired in accompanying lectures covering the subject build the basis for understanding the practical approaches of the projects.
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Parniske
Language(s)	English

Module: WP 16 Extension Topic Human Biology –practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 16.1 Practical course in Human Biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Students learn in a pre-organized practical course methods and procedures to solve typical problems of the field. During the course, they are instructed and supervised by scientists who teach the state-of-the-art techniques. Theoretical knowledge acquired in accompanying lectures covering the subject area build the basis for understanding the practical approaches of the projects.
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Leonhardt, Prof. Meilinger
Language(s)	English

Module: WP 17 Extension Topic Moleculare Plant Sciences – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 17.1 Practical course in Plant Sciences	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group with expertise in the field of Moleculare Plant Sciences and get involved in a current research project. They are supervised by professional scientists thereby insuring that students learn to tackle an actual scientific project by using state-of-the-art techniques of the subject area. Theoretical knowledge acquired in accompanying lectures covering the subject build the basis for understanding the practical approaches of the projects.
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Leister, Prof. Nickelsen
Language(s)	English

Module WP 18 Extension Topic Immunology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 18. Practical course in Immunology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 1 semester.
Content	Students work in the laboratory in small research groups to explore state-of-the-art techniques used in the field of Immunology. Supervised by professional scientists, students get involved in current research projects, apply modern techniques, translate their theoretical knowledge into practical skills and discuss the obtained results on an elevated scientific level.
Learning outcomes	Students acquire expertise in: - Independent planning and execution of scientific experiments - Transfer of theoretical knowledge to practical applications - Critical interpretation and evaluation of experimental data - Processing, discussion and presentation of research data and results
Type of examination	Written report, oral presentation and discussion of the acquired data. Evaluation of practical and social skills within the research groups, preparation of the experiments and motivation during the practical course.

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Veit Hornung
Language(s)	English

Module: WP 19 Extension Topic Cell biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 19.0.1 Advanced lecture on Cell biology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 19.0.2 Lecture on Advanced Methods in Cell biology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 19.0.3 Lecture on Cell- and Developmental Biology of Plants	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 19.0.4 Lecture on Fundamentals in Cell biology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 19.0.5 Special lecture on Cell biology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 19.0.6 Special lecture on Methods in Cell biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 19.0.1 - WP 19.0.6, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The module introduces special professional knowledge from the field of Cell Biology. Two lectures covering basic principles and current topics of Cell Biology are chosen.
Learning outcomes	Students acquire knowledge in basic principles in Cell Biology and are introduced to current research in Cell Biology. They broaden their already acquired knowledge with current and special topics from Cell Biology. New information get integrated in existing knowledge to formulate and discuss scientific

	problems. The acquired theoretical knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	PD Dr. Dejana Mokranjac
Language(s)	English

Module: WP 20 Extension Topic Microbiology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 20.0.1 Advanced lecture on Microbiology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 20.0.2 Special lecture on Microbiology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 20.0.3 Special lecture on Methods in Microbiology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 20.0.1 - WP 20.0.3, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The module introduces special professional knowledge from the field of Microbiology. Two lectures covering basic principles and current topics of Microbiology are chosen.
Learning outcomes	Students acquire knowledge in basic principles in Microbiology and are introduced to current research in Microbiology. They broaden their already acquired knowledge with current and special topics from Microbiology. New information get integrated in existing knowledge to formulate and discuss scientific problems. The acquired theoretical knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. K. Jung
Language(s)	English

Module: WP 21 Extension Topic Virology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 21.1 Current Topics in Virology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 21.2 Lecture in Virology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Virology. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in Virology and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Virology and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Baldauf
Language(s)	English

Module: WP 22 Extension Topic Evolutionary Biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 22.1 Current topics in Evolutionary Biology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 22.2 Lecture in Evolutionary Biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Evolutionary Biology. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in Evolutionary Biology and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Evolutionary Biology and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	
Language(s)	English

Module: WP 23 Extension Topic Neurosciences

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 23.1 Current topics in Neurosciences	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 23.2 Lecture on Neurosciences	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The lecture module mediates current professional knowledge from the field of Neurosciences. Students choose two lectures covering basic principles of the field and current topics. The lectures address in depth the topics of the subject area and introduce concepts of the underlying mechanisms in the research area. Students will be obtain an understanding of concepts in this particular field that might overlap with other subject areas. Upon comprehension of basic principles, more specialized areas of the subject will be introduced in advanced lectures.
Learning outcomes	Students learn about basic principles in Neurosciences and are introduced to literature searches for the latest research results. They broaden their already acquired knowledge with current and special topics from Neurosciences and integrate the new information into existing knowledge. This newly gained insights will be implemented during the practical course.
Type of examination	Written exam or oral examination

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Busse
Language(s)	English

Module: WP 24 Extension Topics Informatics: Introduction to Informatics: Systems and Applications

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 24.1 Introduction in Informatics: Systems and Applications	SoSe	30 h (2 SWS)	60 h	(3)
Exercise course	WP 24.2 Exercise to lecture "Introduction in Informatics: Systems and Applications"	SoSe	45 h (3 SWS)	45 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Optional module with compulsory courses.
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Regelsemester: 2
Duration	The completion of the module takes 1 semester.
Content	This lecture provides a broad introduction to the most important topics in computer science from a system-oriented and application-oriented perspective in order to create the basis for understanding more advanced topics from these subject areas: • Basics of computer hardware (von Neumann model, multi-core processors, working and permanent memory, etc.) • Basics of operating systems (process model, synchronization of concurrent processes, memory management, etc.) • Basics of computer networks (ISO/OSI model, in particular media access, routing, etc. and TCP/IP) • Basics of database systems (relational model, relational algebra, SQL, database design, etc.) • Basics of data mining (classification, cluster analysis, outlier handling, association rules, etc.)

	The module consists of a lecture and exercises in small groups. The content discussed in the lecture is practiced in the practical part using practical applications.
Learning outcomes	Knowledge of the most important fundamentals of computer science from a system-oriented and application-oriented perspective. The aim of the course is to convey a basic understanding of the most important processes in the computer system from the hardware perspective as well as from the perspective of the operating system and the system software (including communication via computer networks) at a suitable scientific abstraction level. Important basic knowledge from the application areas of database systems and data mining should also be taught at a university level.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Böhm
Language(s)	German

Module: WP 25 Extension Topics Informatics: Computer Architecture

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 25.1 Lecture Computer Architecture	SoSe	45 h (3 SWS)	45 h	(3)
Exercise course	WP 25.2 Exercises to WP 25.1	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	2
Duration	The completion of the module takes 1 semester.
Content	This module provides an overview of the binary representation of information on computers, as well as the architecture and operation of modern computers according to von Neumann. The classical components of a computer are introduced. Their interaction is first dealt with theoretically and then practically using a machine language and an assembly language. It is shown how simple circuits and also more complex components of a processor and memory can be systematically designed and optimized with the help of Boolean algebra. The following are covered in detail: • Methods for binary representation of information in the computer, • Realization of memory using switching mechanisms as well as optical and magnetic media, • Boolean algebra for the design of circuits, • Design and optimization of simple logic circuits in processors,

	• Components of the von Neumann architecture and their optimization, • machine-oriented assembler programming, • the interaction of the lower levels of a computer, as well as parallelization and multiprocessor systems.
Learning outcomes	The aim of the module is to provide students with a detailed understanding of von Neumann's computer architecture, binary information representation and memory realization. They should learn to design and optimize logical circuits independently using Boolean algebra. The use of machine and assembly languages should deepen the aforementioned concepts. Students should thus learn to understand how the lower levels of a computer work and the effects of machine architecture on the execution of programs in higher languages.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Claudia Linnhoff-Popien
Language(s)	German

Module: WP 26 Extension Topics Informatics: Programming and Modeling

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 26.1 Lecture „Programming and Modeling	SoSe	30 h (2 SWS)	30 h	(2)
Exercise course	WP 26.2 Exercises to WP 26.1	SoSe	45 h (3 SWS)	75 h	(4)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Regelsemester: 2
Duration	The completion of the module takes 1 semester.
Content	This module introduces the basic principles of functional programming and data modeling. Emphasis is placed on conceptual clarity and a precise theoretical foundation using formal methods. The topics include, for example • The concept of function and basic types, • Recursion and termination, • User-defined data types, • polymorphism, type classes, modules, • higher order functions and currying, • Types, type checking, type inference, • pattern matching, • Delayed evaluation, strictness Inputs and outputs and other side effects.
Learning outcomes	The module aims to teach the following: • Mastery of basic concepts of (general as well as declarative) programming. • Ability to program small algorithms functionally and to evaluate them in comparison with imperative solutions.

	• Preparation for the future development of programming languages.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Brey
Language(s)	German

Module: WP 27 Main Topic Cell Biology I

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 27.0.1 Advanced lecture on Cell biology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 27.0.2 Lecture on Advanced Methods in Cell biology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 27.0.3 Lecture on Cell- and Developmental Biology of Plants	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 27.0.4 Lecture on Fundamentals in Cell biology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 27.0.5 Special lecture on Cell biology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 27.0.6 Special lecture on Methods in Cell biology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 27.0.1 - WP 27.0.6, three courses must be taken.
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The module introduces special professional knowledge from the field of Cell Biology. Three lectures covering basic principles and current topics of Cell Biology are chosen.
Learning outcomes	Students acquire knowledge in basic principles in Cell Biology and are introduced to current research in Cell Biology. They broaden their already acquired knowledge with current and special topics from Cell Biology. New information get integrated in existing knowledge to formulate and discuss scientific

	problems. The acquired theoretical knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	PD Dr. Dejana Mokranjac
Language(s)	English

Module: WP 28 Main Topic Microbiology I

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 28.1 Advanced lecture on Microbiology	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 28.2 Special lecture on Microbiology	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 28.3 Special lecture on Methods in Microbiology	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	The module introduces special professional knowledge from the field of Microbiology. Three lectures cover basic principles and current topics of Microbiology.
Learning outcomes	Students acquire knowledge in basic principles in Microbiology and are introduced to current research in Microbiology. They broaden their already acquired knowledge with current and special topics from Microbiology. New information get integrated in existing knowledge to formulate and discuss scientific problems. The acquired theoretical knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent

	mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. K. Jung
Language(s)	English

Module: WP 29 Main Topic Inorganic Chemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 29.1 Seminar in Anorganic Chemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical course	WP 29.2 Research practical in Anorganic Chemistry	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	Students are involved in current research projects in inorganic chemistry in research groups. Under the guidance of a scientifically qualified supervisor, the students supplement, deepen and apply the methodological and theoretical knowledge from the Bachelor's degree course, as well as new techniques. They are also encouraged to carry out independent scientific work. This includes the planning and development of experiments, their safe and ecological execution, as well as the precise scientific analysis and evaluation of the experiment. In the accompanying seminar, students expand their specialist knowledge of the research topic, present and discuss their own and other current research results from the field of inorganic chemistry.

Learning outcomes	Students acquire skills for chemical and physical research. These include • independently conduct scientific literature searches in a targeted manner, and present, identify, and cite appropriate papers. • understanding, using, modifying, and applying suitable Instructions and protocols. • to learn and deepen the planning and handling of complex experimental setups (including Schlenk technology, high pressure, distillation, crystallization and chromatography techniques). • recognize and assess safety issues when handling hazardous substances • make decisions and critically interpret and evaluate experimental data. • assess, present and discuss research results.
Type of examination	Lab report or lab assessment
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Klapötke, PD Dr. Jörg Stierstorfer
Language(s)	German/English

Module: WP 30 Main Topic Organic Chemistry - practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 30.1 Seminar in Organic Chemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical laboratory course	WP 30.2 Research practical in Organic Chemistry	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	Students are involved in current research projects in an organic chemistry working group. Under the guidance of a scientifically qualified supervisor, students supplement and deepen their methodological and theoretical knowledge from the Bachelor's degree course during the **internship** and are also encouraged to work independently in a scientific manner. In the **accompanying seminar**, students expand their specialist knowledge of the research topic and present and discuss their own research results.
Learning outcomes	Students acquire skills for work in research, e.g.: • independent, target-oriented literature search • transfer of theoretical knowledge to practical applications

	• planning and execution of complex experimental set-ups • recognition and assess safety issues when handling hazardous substances • decision making and critical interpretation and evaluation of experimental data • assess, present and discuss research results.
Type of examination	Lab report or lab assessment
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Hendrik Zipse
Language(s)	German/English

Module: WP 31 Main Topic Physical Chemistry - practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 31.1 Seminar in Physical Chemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical laboratory course	WP 31.2 Research practical in Physical Chemistry	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	Introduction to current topics in physical chemistry by working on a selected scientific project while being integrated into a research group. Development of the required subject and methodological expertise on the level of a scientifically-oriented Master's program. Finding solutions to open scientific questions.
Learning outcomes	Independent application of the subject and methodological expertise established within the study program of physical chemistry by addressing scientific problems. Supervised analysis and evaluation of the obtained results with respect to the current literature and state of knowledge. Providing a written report including results and discussion of the findings, considering the current state of knowledge. Qualified presentation of the results.

Type of examination	Lab report or lab assessment
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Frédéric Laquai
Language(s)	German/English

Module: WP 32 Main Topic Theoretical Chemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Seminar	WP 32.1 Seminar in Theoretical Chemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Practical laboratory course	WP 32.2 Research practical in Theoretical Chemistry	WiSe and SoSe	240 h (16 SWS)	120 h	(12)

For successful completion of the module, 15 ECTS credits have to be acquired. Class attendance averages about 18 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 2
Duration	The completion of the module takes 2 semesters.
Content	Students are introduced to current topics in theoretical chemistry by working on a selected scientific project integrated into a research group. Development of the required knowledge on the level of a scientifically oriented master's program, problem solving and testing of solutions to open scientific questions.
Learning outcomes	Independent application of the expertise established within the study program of theoretical chemistry by working on scientific problems. Supervised discussion and evaluation of the achieved results with respect to the scientific literature. Writing a report on the results and their discussion considering current knowledge. Qualified presentation of the results.
Type of examination	Lab report or lab assessment

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Ochsenfeld, Prof. Dr. Fingerhut
Language(s)	German/English

Module: WP 33 Extension Topic Cell biology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 33.1 Research practical course in Cell biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group from the field of Cell Biology. Supervised by a professional scientist students get involved in a current research project. During the practical course they apply modern techniques and acquire methodical skills and theoretical knowledge in Cell biology. Students learn to plan and execute scientific experiments independently.
Learning outcomes	Students acquire expertise for work in research: - Independent, target-oriented literature search - Transfer of theoretical knowledge to practical applications - Planning and execution of complex experimental set-ups - Recognition and estimation of security questions while handling hazardous material - Decision making and critical interpretation and evaluation of experimental data - Appraisal, presentation and discussion of research data and results

Type of examination	Written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	PD Dr. Dejana Mokranjac
Language(s)	English

Module: WP 34 Extension Topic Microbiology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 34.1 Research practical course in Microbiology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group from the field of Microbiology. Supervised by a professional scientist students get involved in a current research project. During the practical course they apply modern techniques and acquire methodical skills and theoretical knowledge in Micro biology. Students learn to plan and execute scientific experiments independently.
Learning outcomes	Students acquire expertise for work in research: - Independent, target-oriented literature search - Transfer of theoretical knowledge to practical applications - Planning and execution of complex experimental set-ups - Recognition and estimation of security questions while handling hazardous material - Decision making and critical interpretation and evaluation of experimental data - Appraisal, presentation and discussion of research data and results

Type of examination	Written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. K. Jung
Language(s)	English

Module: WP 35 Externsion Topic Virology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 35.1 Practical course in Virology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester
Content	Students work in a research group with expertise in the field of Virology and get involved in a current research project. They are supervised by professional scientists thereby insuring that students learn to tackle an actual scientific project by using state-of-the-art techniques of the subject area. Theoretical knowledge acquired in accompanying lectures covering the subject build the basis for understanding the practical approaches of the projects
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course.
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Baldauf
Language(s)	English

Module: WP 36 Extension Topic Evolutionary Biology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 36.1 Practical course in Evolutionary Biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students work in a research group with expertise in the field of Evolutionary Biology and get involved in a current research project. They are supervised by professional scientists thereby insuring that students learn to tackle an actual scientific project by using state-of-the-art techniques of the subject area. Theoretical knowledge acquired in accompanying lectures covering the subject build the basis for understanding the practical approaches of the projects.
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	
Language(s)	English

Module: WP 37 Extension Topic Neurobiology – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 37.1 Practical course in Neurobiology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester
Content	Students work in a research group with expertise in the field of Neurobiology and get involved in a current research project. They are supervised by professional scientists thereby insuring that students learn to tackle an actual scientific project by using state-of-the-art techniques of the subject area. Theoretical knowledge acquired in accompanying lectures covering the subject build the basis for understanding the practical approaches of the projects.
Learning outcomes	In this practical course, students work on current problems of the field by applying state-of-the-art methods. Students transfer their theoretical knowledge to practical applications and learn how to plan and execute complex experiments and take precautions while handling potentially hazardous material. In addition to acquiring practical skills, the students learn to reflect on their work and learn to troubleshoot, in case of failures. Critical interpretation and evaluation of results as well as presentation and discussion of research data are acquired to prepare students for scientific communications.

Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Busse
Language(s)	English

Module: WP 38 Extension Topics Informatics: Introduction to Programming - Programming and Software Development

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 38.1 Lecture „Introduction in Programming"	WiSe	60 h (4 SWS)	120 h	(6)
Exercise course	WP 38.2 Exercise to WP 38.1	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 6 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module provides an introduction into imperative, object-oriented and concurrent programming using a high-level programming language. In addition to knowledge of programming, general principles, concepts, methods and techniques for the representation, structuring and processing of data and the development of algorithms are covered. Emphasis is placed on conceptual clarity and differentiation of various concepts. Topics of the lecture include: • Basic concepts of algorithms and programs and their execution, • Syntax of programming languages and their description, • Basic data types (primitive data types and reference data types such as arrays) and imperative control structures, • Basics of the complexity and correctness of imperative programs, • Recursion, • Simple sorting methods,

	• Introduction to object-oriented program design and its graphical modeling (UML classes and object diagrams), • Classes, interfaces, packages and inheritance, • Exception handling, • Object-oriented realization of dynamic data structures (lists, trees), • Generic data types, • Use of existing APIs, • Basic concepts of concurrent programming: threads, synchronization and jamming. • Use of an integrated development environment
Learning outcomes	Students are enabled to algorithmically implement solutions for smaller and manageable problems and to realize them as executable programs using a higher programming language. The use of an integrated development environment promotes professionalization. Furthermore, students develop an understanding of the general principles of computer science, programming and programming languages, which lays the foundation for students to be able to quickly and precisely familiarize themselves with new programming languages (after gaining further experience during the course of their studies).
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Sven Stickroth
Language(s)	German
Additional information	This course has to be taken for the extension topic Informatics and as a second lecture one of the other lectures in the module catalogue for the extension topic Informatics can be chosen.

Module: WP 39 Extension Topic Informatics: Operating systems

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 39.1 Lecture „Operating systems“	WiSe	45 h (3 SWS)	45 h	(3)
Exercise course	WP 39.2 Exercise to WP 39.1	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 5 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module provides an introduction into the relevant components of modern operating systems. Methods for process management and process control, in particular for concurrent processes, are discussed first. In particular, methods for recognizing and avoiding conflicts (deadlocks and race conditions) with multiple access to shared resources are covered. The following are taught in detail: • the development history of operating systems • strategies for process management in operating systems • the support of the operating system for the parallelization of programs • strategies for resource management and process coordination • techniques for memory management and for controlling input and output channels • local and distributed interprocess communication This module provides students with the necessary basic knowledge to make targeted use of the special structure

	and technical properties of modern operating systems. This provides an important basis for later familiarization with the development of optimized and scalable programs for modern operating systems.
Learning outcomes	This module provides students with the necessary basic knowledge for the targeted use of the special structure and technical properties of modern operating systems. This provides an important basis for later familiarization with the development of optimized and scalable programs for modern operating systems.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Claudia Linnhoff-Popien
Language(s)	German

Module: WP 40 Subject specific Extension Topic in Biochemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 40.1 Practical course in Subject specific Extension Topic in Biochemistry	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The module introduces students to current, Biochemistry-related research topics. Students work on a selected scientific project and are integrated in a research group. Students acquire the fundamentals of the selected research topic on the level of a scientific orientated Master's programme and develop possible solutions to open scientific problems.
Learning outcomes	- Independet application of acquired skills and competences on a scientific problem - Evaluation of the own research results - Written presentation of results in reference to the scientific environment - Professional presentation of results
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent

	mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Dr. J. Turck
Language(s)	English

Module: WP 41 Subject specific Extension Topic in Biochemistry

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 41.1 Lecture on Subject specific Extension Topic in Biochemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 41.2 Advanced Topics in Subject specific Extension Topic in Biochemistry	WiSe and SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module complements knowledge in Biochemistry. Students select two Biochemistry-related courses.
Learning outcomes	The courses introduce students to up-to-date topics of Biochemistry. Students broaden their knowledge with current and special information. This information should get intregrated in existing knowledge to express and discuss scientific problems. The acquired knowledge will be implemented during the practical course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Dr. J. Turck

Language(s)	English

Module: WP 42 Extension Topic Chemical Biology - practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 42.1 Research practical in Chemical Biology	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students are integrated into current research projects in a working group in biological chemistry. Under the guidance of a scientifically qualified supervisor, students supplement and deepen the methodological and theoretical knowledge gained in their bachelor's degree in the **practical training**, and are also encouraged to work independently on scientific projects.
Learning outcomes	Students acquire competences for research work. These would be • Independently carry out scientific literature research in a targeted manner • Learn how to plan and handle complex experimental set-ups • Recognise and assess safety issues when handling hazardous biological and chemical substances • Make decisions and critically interpret and evaluate experimental data

	• assess, present and discuss research results.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Thomas Carell
Language(s)	German/English

Module: WP 43 Extension Topic Chemical Biology

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 43.1 Basics of Cloning, Genomics and Proteomics	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 43.2 Coenzymes and Biosynthesis	WiSe and SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The course covers the regulations of genetic engineering. Cloning strategies and the purification of proteins are explained. The methods of modern protein analysis and proteomic analysis are explained and it is shown how chemical tools can be used to solve biological questions. Possibilities for the modification of proteins are discussed. Modern methods of genome sequencing and editing are explained and relationships between chemistry and biology are highlighted. The basic biosynthetic pathways of amino acids, sugars and nucleic acids are presented and their significance for pharmaceutical interventions is demonstrated. The reaction mechanisms of cofactors are explained and these are linked to the mechanisms of organic reactions. The basics of enzyme catalysis are taught and links to organic synthesis are shown. Disease relevant cellular

	cellular pathways are discussed together with the basis principles of medicinal chemistry.
Learning outcomes	The students • can transfer the basic principles of how biomolecules are chemically modified to substance classes not explicitly covered in the practical part of the course. • will learn to study and to characterize the purity of biomolecules with the help of modern techniques such as mass spectrometry and sequencing. • will learn the basic safety regulations important for handling and working with genetically modified organism. Students learn the basic principles of biosynthetic pathways and are able to establish cross-relationships between chemistry, biochemistry and medicine.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Thomas Carell
Language(s)	German/English

Module: WP 44 Extension Topic Inorganic Chemistry - practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 44.1 Research practical in Inorganic Chemistry	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students are involved in current research projects in inorganic chemistry working groups. Under the guidance of a scientifically qualified supervisor, the students supplement, deepen and apply the methodological and theoretical knowledge from the Bachelor's degree course, as well as new techniques. They are also encouraged to carry out independent scientific work. This includes the planning and development of experiments, their safe and ecological execution, as well as the precise scientific analysis and evaluation of the experiment.
Learning outcomes	Students acquire skills for chemical and physical research. These include • independently conduct scientific literature searches in a targeted manner, and present, identify, and cite appropriate papers.

	• understanding, using, modifying, and applying suitable Instructions and protocols. • to learn and deepen the planning and handling of complex experimental setups (including Schlenk technology, high pressure, distillation, crystallization and chromatography techniques). • recognize and assess safety issues when handling hazardous substances • make decisions and critically interpret and evaluate experimental data. • assess, present and discuss research results.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Klapötke
Language(s)	German/English

Module: WP 45 Extension Topic Inorganic Chemistry

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 45.2 Modern Inorganic Main-group Chemistry (T1ID)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.2 Solid State Chemistry II (T1IE)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.3 Coordination Chemistry II (T1IF)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.4 Spectroscopic Methods (T1IG)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.5 Special Lectures in Inorganic Chemistry (T1IZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.6 Modern NMR-Spectroscopy in Liquids (T1IG-2)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.8 Chemistry of High-Energy Materials (T1IZ-6)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.9 Intermetallic Phases (T1IZ-7)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 45.10 Principles of Nanochemistry and Functional Materials (T1IZ-8)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 45.2 - WP 45.10, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 3

Duration	The completion of the module takes 1 semester.
Content	This module deepens expertise in the field of inorganic chemistry through the selection of three specialization courses. In the compulsory colloquium, expert talks are given by visiting professors or young scientists on common or current topics in inorganic chemistry.
Learning outcomes	In the lectures, students are introduced to modern topics of current inorganic chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Klapötke
Language(s)	German/English

Module: WP 46 Extension Topic Organic Chemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 46.1 Research practical in Organic Chemistry	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students are involved in current research projects in an organic chemistry working group. Under the guidance of a scientifically qualified supervisor, students supplement and deepen their methodological and theoretical knowledge from the Bachelor's degree course during the **internship** and are also encouraged to work independently in a scientific manner.
Learning outcomes	Students acquire skills for work in research, e.g.: • independent, target-oriented literature search • transfer of theoretical knowledge to practical applications • planning and execution of complex experimental set-ups • recognition and assess safety issues when handling hazardous substances

	• decision making and critical interpretation and evaluation of experimental data assess, present and discuss research results.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Hendrik Zipse
Language(s)	German/English

Module: WP 47 Minor Organic Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 47.2 Physical-Organic Chemistry (T1OD)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.3 The Chemistry of Heterocycles (T1OE)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.4 Modern Synthetic Methods (T1OF)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.5 Synthesis Planning (T1OG)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.6 Glycochemistry (T1OH)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.7 Radicals in Chemistry and Biology (T1OI)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.8 Lecture in Chemical Biology (T1OJ)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.9 Advanced Topics in Chemical Biology (T1OK)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.10 Special Lecture in Organic Chemistry (T1OZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.11 Supramolecular Chemistry (T1OS)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.12) Organic and Bio-inspired Molecular Systems (T1OM)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.13 Multi-Dimensional NMR Spectroscopy for Structure Elucidation of Big Molecules (T1OL)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 47.14 Concepts and Tools in Chemical Biology (T1OR)	SoSe/	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses

Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 47.0.1 - WP 47.0.9, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens special technical knowledge in the field of organic chemistry through the selection of three specialization courses. In the compulsory organic chemistry colloquium, internal and external experts present current research results from organic chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current organic chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Hendrik Zipse
Language(s)	German/English

Module: WP 48 Extension Topic Physical Chemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 48.1 Research practical in Physical Chemistry	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Introduction to current topics in physical chemistry by working on a selected scientific project while being integrated into a research group. Development of the required subject and methodological expertise on the level of a scientifically-oriented Master's program. Finding solutions to open scientific questions.
Learning outcomes	Independent application of the subject and methodological expertise established within the study program of physical chemistry by addressing scientific problems. Supervised analysis and evaluation of the obtained results with respect to the current literature and state of knowledge. Providing a written report including results and discussion of the findings, considering the current state of knowledge. Qualified presentation of the results.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course

Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Frédéric Laquai
Language(s)	German/English

Module: WP 49 Extension Topic Physical Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 49.2 Energy Conversion (T1PD)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.3 Introduction to Electron Microscopy (T1PF)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.4 Microscopy for Nanotechnology (T1PG)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.5 Fluorescence Microscopy and Spectroscopy (T1PI)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.6 Laserspectroscopy (T1PJ)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.7 Heterogeneous Catalysis (T1PK)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.8 Surface Physics (T1PL)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.9 Special Lecture in Physical Chemistry (T1PZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.10 Single Molecule Experiments (T1PN)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.11 DNA-Nanotechnology (T1PP)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.12 Physical characterization of solid-state nanostructures (T1PR)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.13 Biomolecular Self-Assembly (T1PT)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.14 Protein Design and Structural Prediction (T1PU)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 49.15 Electronic Processes in Semiconductors (T1PW)	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 49.0.1 - WP 49.0.11, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens special technical knowledge in the field of physical chemistry through the selection of three specialization courses. In the compulsory physical chemistry colloquium, internal and external experts present current research results from physical chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current physical chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Wintterlin
Language(s)	German/English

Module: WP 50 Extension Topic Theoretical Chemistry – practical course

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Practical laboratory course	WP 50.1 Research practical in Theoretical Chemistry	WiSe and SoSe	150 h (10 SWS)	120 h	(9)

For successful completion of the module, 9 ECTS credits have to be acquired. Class attendance averages about 10 contact hours. Including time for self-study, 270 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	Students are introduced to current topics in theoretical chemistry by working on a selected scientific project integrated into a research group. Development of the required knowledge on the level of a scientifically oriented master's program, problem solving and testing of solutions to open scientific questions
Learning outcomes	Independent application of the expertise established within the study program of theoretical chemistry by working on scientific problems. Supervised discussion and evaluation of the achieved results with respect to the scientific literature. Writing a report on the results and their discussion considering current knowledge. Qualified presentation of the results.
Type of examination	Written report on or assessment of the practical laboratory course or written report on and assessment of the practical laboratory course
Type of assessment	The successful completion of the module will be graded.

Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Ochsenfeld, Prof. Dr. Fingerhut
Language(s)	German/English

Module: WP 51 Extension Topic Theoretical Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course Type	Course Title (optional courses)	Rotation	Contact Hours	Self-directed Studies	ECTS
Lecture	WP 51.2 Theory of chemical dynamics: Molecular dynamics (T1TD)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 51.3 Theory of chemical dynamics: Quantum dynamics (T1TE)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 51.4 Linear Scaling Quantum Methods for large Molecules (T1TH)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 51.5 Special Lecture in Theoretical Chemistry (T1TZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 51.6 Theory of energy and electron transfer in photoactive systems (T1TI)	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with compulsory elective courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the compulsory elective courses WP 51.1 - WP 51.6, two courses must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.

Content	This module deepens special technical knowledge in the field of theoretical chemistry through the selection of three specialization courses. In the compulsory theoretical chemistry colloquium, internal and external experts present current research results from physical chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current theoretical chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Ochsenfeld
Language(s)	German/English

Module: WP 52 Main Topic Cell biologiy II

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 52.1 Subject-specific colloquium in Cell Biology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Seminar	WP 52.2 Subject-specific seminar in Cell biology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The module covers important and current literature and methods in Microbiology and introduces up-to-date topics of research in Microbiology. At the **seminar** students extend their expertise of current literature and methods in Microbiology and present and discuss publications covering specific topics and methods. At the **colloquium** visiting professors and junior scientists present up-to-date research topics and results from the field of Microbiology.
Learning outcomes	Students acquire expertise for work in research: - independent, target-oriented literature search - critical interpretion and evaluation of experimental data - appraisal, presention and discussion of research data and results

	- integration of the content of a specific scientific presentation into the broader context of the subject Biochemistry.
Type of examination	Presentation or scientific journal
Type of assessment	The successful completion of the module will not be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	PD Dr. Dejana Mokranjac
Language(s)	English

Module: WP 53 Main Topic Microbiology II

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 52.1 Subject-specific colloquium in Microbiology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)
Seminar	WP 52.2 Subject-specific seminar in Microbiology	WiSe and SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 6 ECTS credits have to be acquired. Class attendance averages about 4 contact hours. Including time for self-study, 180 hours have to be invested.

Module type	Compulsory elective module with mandatory courses
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1).
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	The module covers important and current literature and methods in Microbiology and introduces up-to-date topics of research in Microbiology. At the **seminar** students extend their expertise of current literature and methods in Microbiology and present and discuss publications covering specific topics and methods. At the **colloquium** visiting professors and junior scientists present up-to-date research topics and results from the field of Microbiology.
Learning outcomes	Students acquire expertise for work in research: - independent, target-oriented literature search - critical interpretion and evaluation of experimental data - appraisal, presention and discussion of research data and results

	- integration of the content of a specific scientific presentation into the broader context of the subject Biochemistry
Type of examination	Presentation of scientific journal
Type of assessment	The successful completion of the module will not be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. K. Jung
Language(s)	English

Module: WP 54 Main Topic Inorganic Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 54.1 Expert colloquium in Inorganic Chemistry (T1ZI)	WiSe/ SoSe	45h (3 SWS)	135 h	(6)

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 54.2 Modern Inorganic Main-group Chemistry (T1ID)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.2 Solid State Chemistry II (T1IE)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.3 Coordination Chemistry II (T1IF)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.4 Spectroscopic Methods (T1IG)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.5 Special Lectures in Inorganic Chemistry (T1IZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.6 Modern NMR-Spectroscopy in Liquids (T1IG-2)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.8 Chemistry of High-Energy Materials (T1IZ-6)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.9 Intermetallic Phases (T1IZ-7)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 54.10 Principles of Nanochemistry and Functional Materials (T1IZ-8)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 15 ECTS credits have to be acquired, including 9 ECTS-credits from compulsory elective courses. Class attendance averages about 9 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory and compulsory elective courses.
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45

	ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the module`s courses, WP 54.1 and three of the compulsory elective courses WP 54.2.1 - WP 54.2.5 must be taken. In doing so, at last two of the compulsory elective courses WP 54.2.1 - WP 54.2.3 must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens expertise in the field of inorganic chemistry through the selection of three specialization courses. In the compulsory colloquium, expert talks are given by visiting professors or young scientists on common or current topics in inorganic chemistry.
Learning outcomes	In the lectures, students are introduced to modern topics of current inorganic chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Klapötke
Language(s)	German/English

Module: WP 55 Main Topic Organic Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 55.1 Expert colloquium in Organic Chemistry(T1ZO)	WiSe/ SoSe	45h (3 SWS)	135 h	(6)

Course type	Course (compulsory elective)	Rotation	Contact hours	Self-study hours	ECTS
Lecture	WP 55.2 Physical-Organic Chemistry (T1OD)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.3 The Chemistry of Heterocycles (T1OE)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.4 Modern Synthetic Methods (T1OF)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.5 Synthesis Planning (T1OG)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.6 Glycochemistry (T1OH)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.7 Radicals in Chemistry and Biology (T1OI)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.8 Lecture in Chemical Biology (T1OJ)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.9 Advanced Topics in Chemical Biology (T1OK)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.10 Special Lecture in Organic Chemistry (T1OZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.11 Supramolecular Chemistry (T1OS)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.12) Organic and Bio-inspired Molecular Systems (T1OM)	WiSe/	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.13 Multi-Dimensional NMR Spectroscopy for Structure Elucidation of Big Molecules (T1OL)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 55.14 Concepts and Tools in Chemical Biology (T1OR)	SoSe/	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 15 credits have to be acquired, including 9 ECTS credits from compulsory elective courses. Class attendance averages about 9 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory and compulsory elective courses.
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the module's courses, WP 55.1 and three of the compulsory elective modules WP 55.2.1 - WP 55.2.9 must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens special technical knowledge in the field of organic chemistry through the selection of three specialization courses. In the compulsory organic chemistry colloquium, internal and external experts present current research results from organic chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current organic chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact	Prof. Dr. Hendrik Zipse
Language(s)	German/English

Module: WP 56 Main Topic Physical Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 56.1 Expert colloquium in Physical Chemistry (T1ZP)	WiSe/ SoSe	45 h (3 SWS)	135 h	(6)
Lecture	WP 56.2 Energy Conversion (T1PD)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.3 Introduction to Electron Microscopy (T1PF)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.4 Microscopy for Nanotechnology (T1PG)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.5 Fluorescence Microscopy and Spectroscopy (T1PI)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.6 Laserspectroscopy (T1PJ)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.7 Heterogeneous Catalysis (T1PK)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.8 Surface Physics (T1PL)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.9 Special Lecture in Physical Chemistry (T1PZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.10 Single Molecule Experiments (T1PN)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.11 DNA-Nanotechnology (T1PP)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.12 Physical characterization of solid-state nanostructures (T1PR)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.13 Biomolecular Self-Assembly (T1PT)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.14 Protein Design and Structural Prediction (T1PU)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 56.15 Electronic Processes in Semiconductors (T1PW)	WiSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 15 ECTS credits have to be acquired, including 9 ECTS credits from compulsory elective courses. Class attendance averages about 9 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory and compulsory elective courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the module's courses, WP 56.1 and three of the compulsory elective courses WP 56.2.1 - WP 56.2.11 must be taken.
Entry requirements	None
Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens special technical knowledge in the field of physical chemistry through the selection of three specialization courses. In the compulsory physical chemistry colloquium, internal and external experts present current research results from physical chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current physical chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Wintterlin

Language(s)	German/English

Module: WP 57 Main Topic Theoretical Chemistry (Lectures)

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Colloquium	WP 57.1 Expert colloquium in Theoretical Chemistry (T1ZT)	WiSe/ SoSe	45h (3 SWS)	135 h	(6)
Lecture	WP 57.2 Theory of chemical dynamics: Molecular dynamics (T1TD)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 57.3 Theory of chemical dynamics: Quantum dynamics (T1TE)	WiSe	30 h (2 SWS)	60 h	(3)
Lecture	WP557.4 Linear Scaling Quantum Methods for large Molecules (T1TH)	SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP 57.5 Special Lecture in Theoretical Chemistry (T1TZ)	WiSe/ SoSe	30 h (2 SWS)	60 h	(3)
Lecture	WP57.6 Theory of energy and electron transfer in photoactive systems (T1TI)	SoSe	30 h (2 SWS)	60 h	(3)

For successful completion of the module, 15 ECTS credits have to be acquired, including 9 ECTS credits from compulsory elective courses. Class attendance averages about 9 contact hours. Including time for self-study, 450 hours have to be invested.

Module type	Compulsory elective module with mandatory and compulsory elective courses
Usability of the module in other Programmes	Master Chemistry
Elective guidelines	With regard to the compulsory elective modules WP 1 - WP 57, modules must be taken with a total value of 45 ECTS credits. (For detailed information on the elective guidelines see description of Module WP 1). With regard to the module's courses, WP 57.1 and three of the compulsory elective courses WP 57.2.1 - WP 57.2.6 must be taken.
Entry requirements	None

Semester	Recommended semester: 3
Duration	The completion of the module takes 1 semester.
Content	This module deepens special technical knowledge in the field of theoretical chemistry through the selection of three specialization courses. In the compulsory theoretical chemistry colloquium, internal and external experts present current research results from physical chemistry. In the follow-up to these scientific lectures, students deal with the current specialist literature.
Learning outcomes	In the lectures, students are introduced to modern topics in current theoretical chemistry. In doing so, they expand their previously acquired knowledge with current and specialized technical information. The information is to be integrated into existing knowledge in order to formulate and discuss scientific questions. The acquired theoretical knowledge should be applied in the practical part of the course.
Type of examination	Written exam or oral examination
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.
Responsible contact	Prof. Dr. Ochsenfeld
Language(s)	German/English

Module: P 6 Master's Degree Module

Programme	Master's Programme: Biochemie (Master of Science, M.Sc.)

Related module parts

Course type	Course (mandatory)	Rotation	Contact hours	Self-study hours	ECTS
Master's thesis	P 6.1 Master thesis	WiSe and SoSe	-	900 h	(30)

For successful completion of the module, 30 ECTS credits have to be acquired and 900 hours have to be invested.

Module type	Mandatory module
Usability of the module in other Programmes	None
Elective guidelines	None
Entry requirements	Successful completion of the modules P 1 - P 3 and P 5
Semester	Recommended semester: 4
Duration	The completion of the module takes 1 semester.
Content	Focus of the thesis is the work on a special question from Biochemistry, Cell Biology, Microbiology or any Extension Topic, including a written scientific report.
Learning outcomes	Competence to compile and present a focused topic during 6 months in a complete manner. Ability to work in a team and on a project. The students get theoretical and practical understanding in specific challenges in Biochemistry, Cell Biology, Microbiology or any Extension Topic. They can design and execute experiments addressing a given topic correctly, as well as present and discuss the results in a report in proper form and content.
Type of examination	Master's thesis
Type of assessment	The successful completion of the module will be graded.
Requirements for the gain of ECTS credits	ECTS credits will be granted when the module examination (or the examination of pertinent mandatory and potential elective compulsory module parts) has/have been completed successfully.

Responsible contact	Prof. Stingele
Language(s)	English