

Module Catalogue
Master of Science *Medicinal Chemistry*
University of Regensburg

The Master program in Medicinal Chemistry at the University of Regensburg comprises the following modules:

1. Basic Modules (compulsory)
 - MCH-MSc-M 01: Basic module Medicinal Chemistry
 - MCH-MSc-M 02: Basic module Organic Chemistry
 - MCH-MSc-M 03: Basic module Bioanalytical Chemistry

2. Advanced Modules (compulsory)
 - MCH-MSc-M 04: Advanced module Medicinal Chemistry I
 - MCH-MSc-M 05: Advanced module Organic Chemistry
 - MCH-MSc-M 06: Advanced module Medicinal Chemistry II

3. Master Thesis (compulsory)
 - MCH-MSc-M 07: Module Master Thesis



1. BASIC MODULES (compulsory)

MCH-MSc-M 01

1. Module Name:	Basic Module Medicinal Chemistry
2. Field / Person in Charge:	Chemistry / Prof. Dr. Armin Buschauer
3. Synopsis:	<p>The lectures of the basic module Medicinal Chemistry address general and special pharmaceutical/ medicinal chemistry as well as biotechnology. Within this framework both, the basic concepts of drug chemistry (ligand-receptor interactions, qualitative and quantitative relationships of structure and activity, computer-based methods, drug design, structure and functions of the most important target molecules) and a more detailed insight in specific drug chemistry will be discussed for selected substance classes and areas of indication. This more detailed perspective will address the chemistry (synthesis, chemical properties) of the respective drugs, their mode of action and structure-activity relationships, the underlying pharmacotherapeutic concepts, desired and important undesired drug effects as well as the biotransformation of drugs.</p> <p>The lecture "Basics of Biotechnology" covers aspects of industrial microbiology (basics of microbiology and cell biology, large scale cultivation of microorganisms) and of molecular biotechnology (e.g. recombinant DNA techniques). The production of microbial primary and secondary metabolites, the extraction and use of biotechnologically relevant enzymes, the application of microbial transformations as well as the production of recombinant proteins will be explained by appropriate examples.</p> <p>The course "Computational Methods in Medicinal Chemistry" teaches the theoretical basics of molecular modelling and covers essential structure and ligand-based approaches for the generation and optimization of lead structures. Application of these methods will be done on examples in a lab course (computer course using the software suite SYBYL).</p>
4. Competences Acquired:	Students having completed this basic module understand the chemical basis of the biological

	activity of drugs and know important microbiological, pharmacological and computational methods in drug design as well as processes for synthesis and extraction of drugs. They are able both to analyze structure-activity relationships and to recognize correlations, to apply concepts to other drugs and to understand current developments in drug research due to their thorough study of important drug classes.
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in organic chemistry and biochemistry obtained in a previous basic study of chemistry or a related course of studies.
b) Compulsory Certificates: to be submitted instantly <input type="checkbox"/> to hand in till <input type="checkbox"/>	none
6. Module Accepted in:	M.Sc. Medicinal Chemistry
7. Module Start:	Every winter semester
8. Module Duration:	2 semesters
9. Recommended Semester in Major:	1. and 2. semester in major
10. Total workload of the module / credit points:	580 hours/ 19 credit points* (240 h attendance time, 330 h home study including preparation for examination)

*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	P	V	Lecture General Medicinal Chemistry	2	Exam (passed/not passed) duration: 90 minutes
2	P	V	Lecture Medicinal Chemistry I	4	Exam (passed/not passed) duration: 150 minutes
3	P	V	Lecture Medicinal Chemistry II	4	Exam (passed/not passed) duration: 150 minutes
4	P	V	Lecture Biotechnology	2	

5	P	P+S	Computational Methods in Medicinal Chemistry	4	
Remarks:					

* P = required course; WP = elective compulsory course; W = elective course

12. Module Examination:

A/T*	Mode and content of examination	Prerequisites for admission **	Duration	Time	Mode of grading
A	Oral module final examination covering the courses given in 11.	Successful completion of the courses given under Nr 11)	30 min	After completion of the 2. semester in major or latest in an examination period of the following semester	graded

Remarks: The following periods of examination will be provided:

winter semester: September 1st – December 15th and February 1st – March 31th

summer semester: Mai 1st – May 31th and July 1st – July 31th

* A = module final examination; T = module partial examination ** optional

13. Module Grade:

<input checked="" type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input type="checkbox"/>	The module will not be graded

14. Others:

If the module examination is not passed in the first repetition, a second repetition is possible. This second repetition will be generally an oral examination covering the complete module in presence of at least two examiners. In the case of a second repetition the grade of the examination will correspond to the module grade.



MCH-MSc-M 02

1. Module Name:	Basic Module Organic Chemistry
2. Field / Person in Charge:	Chemistry / Prof. Dr. B. König
3. Synopsis:	<p>In the lab Methods of Synthesis students will exemplarily learn modern methods of organic synthesis in a research-orientated manner and practice the safe experimental handling of demanding laboratory techniques. The experiments cover enantioselective catalysis, organocatalysis, synthesis of heterocycles and drugs, methods of chromatographic separation (DC, GC, HPLC) and the characterization of intermediates and products using spectroscopy. The lab will be accompanied by a seminar (in English), where current fields in Organic Chemistry will be addressed by short presentations of the participants.</p> <p>From the given pool of lectures in Organic Chemistry the students will have to choose four. These lectures will provide deeper insight in the theoretical background of a current research topic or an area of long-time importance, e.g. catalysis, bioorganic chemistry, planning of synthesis, methods of NMR-spectroscopy, synthesis of natural compounds. For these respective fields of Organic Chemistry the basics, the state of the art and current perspectives will be discussed using examples from research.</p>
4. Competences Acquired:	Having completed this basic module students know and understand advanced modern methods and techniques in Organic Chemistry and are able to apply these in theory and practice. This includes the understanding of complex reaction mechanisms, the determination of the structure of more complex organic molecules by spectroscopy, the proposal and the judgement of synthetic pathways as well as the practical completion of technically demanding steps of synthesis and separation in the lab.
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in organic chemistry obtained in a previous basic study of chemistry or a related course of studies
b) Compulsory certificates: to be submitted instantly <input type="checkbox"/> to hand in till <input type="checkbox"/>	none



6. Module Accepted in:	M.Sc. Medicinal Chemistry
7. Module Start:	Every semester
8. Module Duration:	2 semesters
9. Recommended Semester in Major:	1. and 2. semester in major
10. Total workload of the module / credit points:	480 hours/ 16 credit points* (240 h attendance time, 240 h home study including preparation for examination)

**The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.*

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	WP	V	Elective compulsory Lecture Organic Chemistry 1	2	
2	WP	V	Elective compulsory Lecture Organic Chemistry 2	2	
3	WP	V	Elective compulsory Lecture Organic Chemistry 3	2	
4	WP	V	Elective compulsory Lecture Organic Chemistry 4	2	
5	P	P	Methods in Organic Synthesis	6	Oral colloquia before the experiments (Vortestate)
6	P	S	Seminar accompanying the Lab Methods in Organic Synthesis	2	Seminar talk in English covering a given subject

Remarks: Four lectures in Organic Chemistry have to be chosen from the pool (OC sequence A–D). The lectures that will be given can be found in the lecture timetable.

** P = required course; WP = elective compulsory course; W = elective course*

12. Module Examination:					
<i>A/T*</i>	<i>Mode and content of examination</i>	<i>Prerequisites for admission **</i>	<i>Duration</i>	<i>Time</i>	<i>Mode of grading</i>
A	Oral module final examination covering the courses given in 11.	Successful completion of the courses given under Nr 11)	30 min	After completion of the 2. semester in major or in a later examination period	graded
<p>Remarks: The following periods of examination will be provided: winter semester: September 1st – December 15th and February 1st – March 31th summer semester: Mai 1st – May 31th and July 1st – July 31th</p>					

* A = module final examination; T = module partial examination ** optional

13. Module Grade:	
<input checked="" type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input type="checkbox"/>	The module will not be graded

14. Others:
<p>If the module examination is not passed in the first repetition, a second repetition is possible. This second repetition will be generally an oral examination covering the complete module in presence of at least two examiners. In the case of a second repetition the grade of the examination will correspond to the module grade.</p>

CHE-MSc-M 3

1. Module Name:	Basic Module Bioanalytical Chemistry
2. Field / Person in Charge:	Chemistry / Prof. Dr. J. Wegener
3. Synopsis:	<p>Lecture: Sensors, Arrays, Screening</p> <ul style="list-style-type: none"> • Sensors Introduction into Sensors & Biosensing Optical Sensors: Principles, Transducers, Label-based and label-free techniques Electrochemical Sensors: Potentiometric Sensors (Principles, Transducers, Applications), Conductance Sensors (Principles, Transducers, Applications), Amperometric Sensors (Principles, Transducers, Applications) • Arrays Surface immobilization of biomolecules Methods of array production Array readout and analysis Examples (Gen-Chips, Protein-Chips, ...) • Screening Introduction into screening (the omics, HTS vs HCS) Molecular screening (screening schemes for molecular recognition and biological activity) Cell-based screening (cell and tissue culture in vitro, low tech screening assays, high tech screening formats, screening for differential gene expression) <p>Lab Course: Sensors, Arrays, Screening</p> <ul style="list-style-type: none"> • Impedimetric screening with human cells • Immunological screening techniques (ELISA) • Femtoliter Array for Single Molecule Analysis • DNA-Arrays • Screening for molecular recognition • Screening for Cytotoxicity • Soft Lithography for Multifunctional Sensor Surfaces

	<p>Short Lab Course: Chromatography</p> <ul style="list-style-type: none"> • Determination of fatty acids by Solid Phase Extraction (SPE) and Gas Chromatography • Quantitative determination of vitamins using HPLC
<p>4. Competences Acquired:</p>	<p>Having completed this module students are able to</p> <ul style="list-style-type: none"> • analyse a biosensor with regard to its functional principle • develop concepts for biosensor build-up based on known signal transducers and judge different approaches • analyse and compare characteristics of biosensors • develop, judge and apply concepts for immobilization of biomolecules on surfaces • understand and explain design strategies of biosensors • understand High Content and High Throughput Screening approaches • recognize possibilities and limitations of screening approaches • conduct experiments in molecular and cell based screening with low throughput • judge the requirements for a quantitative chromatographic determination of biomolecules in real samples as well as its performance and transfer it to related problems
<p>5. Prerequisites for Participation:</p>	
<p>a) Recommended:</p>	<ul style="list-style-type: none"> • Basic knowledge of Analytical Chemistry obtained during a study of chemistry or a related subject, • Basic knowledge in Biochemistry
<p>b) Compulsory Certificates: to be submitted instantly <input type="checkbox"/> to hand in till <input type="checkbox"/></p>	<p>none</p>
<p>6. Module Accepted in:</p>	<p>M.Sc. Medicinal Chemistry</p>
<p>7. Module Start:</p>	<p>Every summer semester</p>
<p>8. Module Duration:</p>	<p>2 semesters</p>
<p>9. Recommended Semester in Major:</p>	<p>2. and 3. semester in major</p>

10. Total workload of the module	240 hours/ 8 credit points*
/ credit points:	(135 h attendance time, 105 h home study including preparation for examination)

*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	P	V	Lecture Sensors, Arrays, Screening (in English)	3	Exam (passed / not passed) duration: 2 hours
2	P	P	Lab Course Sensors, Arrays, Screening	4	Colloquia to the respective experiments; Lab reports
3	P	P	Chromatographic Methods	2	Lab reports
Remarks: The lecture "Sensors, Arrays, Screening" will be given in English					

* P = required course; WP = elective compulsory course; W = elective course

12. Module Examination:					
<i>A/T*</i>	<i>Mode and content of examination</i>	<i>Prerequisites for admission **</i>	<i>Duration</i>	<i>Time</i>	<i>Mode of grading</i>
A	Oral module final examination covering the courses given in 11.	Successful completion of the courses given under Nr 11)	30 min	After completion of the 2. semester in major, latest in an examination period of the following semester	graded
Remarks: The following periods of examination will be provided: winter semester: September 1 st – December 15 th and February 1 st – March 31 th summer semester: Mai 1 st – May 31 th and July 1 st – July 31 th					

* A = module final examination; T = module partial examination ** optional



13. Module Grade:

<input checked="" type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input type="checkbox"/>	The module will not be graded

14. Others:

If the module examination is not passed in the first repetition, a second repetition is possible. This second repetition will be generally an oral examination covering the complete module in presence of at least two examiners. In the case of a second repetition the grade of the examination will correspond to the module grade.

2. COMPULSORY PART: “Advanced modules”

CH-MSc-M 04

1. Module Name:	Advanced Module Medicinal Chemistry I
2. Field / Person in Charge:	Chemistry / Prof. Dr. Armin Buschauer
3. Synopsis:	<p>In the lab course “Biochemical and pharmacological methods in medicinal chemistry” with accompanying seminar students learn on selected examples the principles, experimental performance and analysis of biological in-vitro assays for the determination of affinity and functional activity of potential drugs (e.g. radio ligand binding assay, investigation of cytotoxicity, determination of enzyme activity, calcium assays, organ-pharmacological investigations).</p> <p>In the research lab the student will be integrated in a current research project of a work group. He will work on a given topic and carries out investigations under supervision of the team leader or an assistant. Doing this the student will be expected to contribute own starting points for the solution of the problem, too.</p>
4. Competences Acquired:	<p>Students having completed this module are able to judge the applicability, the meaningfulness and the advantages and disadvantages of usual standard assays in drug research and to carry through and analyse suitable investigations for the biochemical/pharmacological characterization after appropriate further training.</p> <p>In addition, students will be able to address scientific problems using theoretical and practical skills gained so far and to work on them in the chosen field on their own with appropriate help.</p>
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in organic chemistry obtained in a previous basic study of chemistry or a related course of studies as well as contents of module MCH-MSc-M 01.
b) Compulsory Certificates:	
to be submitted instantly <input type="checkbox"/>	none
to hand in till <input type="checkbox"/>	
6. Module Accepted in:	M.Sc. Medicinal Chemistry



7. Module Start:	Every winter semester
8. Module Duration:	2 semesters
9. Recommended Semester in Major:	1. and 2. semester in major
10. Total workload of the module / credit points:	480 hours/ 16 credit points* (225 h attendance time, 255 h home study including preparation for examination)

*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h</i>	<i>Deliverables</i>
1	P	P	Lab Course Biochemical and Pharmacological Methods in Medicinal Chemistry	8	
2	P	S	Seminar on Biochemical and Pharmacological Methods in Medicinal Chemistry	1	Exam (passed/not passed) duration: 150 minutes
3	P	P	Research Lab (to be chosen from OC/MedChem)	6	Report
Remarks:					

* P = required course; WP = elective compulsory course; W = elective course

12. Module Grade:	
<input type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input checked="" type="checkbox"/>	The module will not be graded

13. Others:

MCH-MSc-M 05

1. Module Name:	Advanced Module Organic Chemistry
2. Field / Person in Charge:	Chemistry / Prof. Dr. B. König
3. Synopsis:	In the preparatory organic lab course the participants solve problems using modern methods of synthesis and analysis, like solid phase reactions, combinatorial synthesis, microreaction techniques, coupled analysis techniques (HPLC-MS) or special metal-, organo- or photocatalytical reactions. During the English spoken seminar the participants will present in short talks the background, possibilities and limitations of the methods using appropriate examples
4. Competences Acquired:	Having completed this module the participants have knowledge on possibilities and limitations of modern synthetic and analytical methods in organic chemistry (combinatorial and solid phase synthesis, microreaction technique, catalysis, coupled analysis techniques). They are able to choose the most appropriate technique for a given problem and to judge its application.
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in organic chemistry obtained in a previous basic study of chemistry or a related course of studies Contents of the module CHE-MSc-M 02 "Basic Module Organic Chemistry"
b) Compulsory Certificates: to be submitted instantly <input type="checkbox"/> to hand in till <input type="checkbox"/>	none
6. Module Accepted in:	M.Sc. Medicinal Chemistry
7. Module Start:	Every summer semester
8. Module Duration:	1 semester
9. Recommended Semester in Major:	2. semester in major
10. Total workload of the module / credit points:	180 hours/ 6 credit points* (90 h attendance time, 90 h home study including preparation for examination)

*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	P	P	Preparative Lab Course Organic Chemistry (in English)	4	Report
2	P	S	Seminar to the Preparative Lab Course Organic Chemistry (in English)	2	Seminar talk in English covering a given subject
Remarks:					

* *P = required course; WP = elective compulsory course; W = elective course*

12. Module Grade:	
<input type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input checked="" type="checkbox"/>	The module will not be graded

13. Others:



MCH-MSc-M 06

1. Module Name:	Advanced Module Medicinal Chemistry II
2. Field / Person in Charge:	Chemistry / Prof. Dr. Armin Buschauer
3. Synopsis:	The module consists of both a method course in the scientific discipline of the master thesis and lectures on special topics in pharmaceutical/medicinal chemistry. The method course covers a deepened instruction on selected scientific methods in the special field of the master thesis and their practical exemplary application. The lecture on selected drug classes serves to supplement and to broaden the knowledge in medicinal chemistry gained in the basic module and the advanced module.
4. Competences Acquired:	The students have broad knowledge in medicinal chemistry with regard to discovery, design, identification and synthesis of biologically active compounds, the interpretation of their mode of action on a molecular scale and are familiar with the most important drug classes. They are able to apply scientific methods in the field of the master thesis both reflected theoretically and experienced in practice.
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in chemistry obtained in a previous basic study of chemistry or a related course of studies. Knowledge in the fields of the modules takes so far in the course of studies (MHE-MSc-M 01 – MCH-MSc-M 05)
b) Compulsory Certificates: to be submitted instantly <input type="checkbox"/> to hand in till <input type="checkbox"/>	none
6. Module Accepted in::	M.Sc. Medicinal Chemistry
7. Module Start:	Every winter semester
8. Module Duration:	2 semesters
9. Recommended Semester in Major:	3. and 4. semester in major



10. Total workload of the module / credit points:	660 hours/ 22 credit points* (270 h attendance time, 390 h home study including preparation for examination)
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*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	P		Method Course	10	
2	P	V	Lecture Medicinal Chemistry III	4	Exam (passed/not passed) duration: 150 minutes
3	P	V	Lecture Medicinal Chemistry III	4	Exam (passed/not passed) duration: 150 minutes
Remarks:					

* P = required course; WP = elective compulsory course; W = elective course

12. Module Grade:	
<input type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.
<input type="checkbox"/>	The module grade is calculated as follows:
<input checked="" type="checkbox"/>	The module will not be graded

13. Others:

3. COMPULSARY PART: “Module Master thesis”

MCH-MSc-M 07

1. Module Name:	Master thesis
2. Field / Person in Charge:	Prof. Dr. Armin Buschauer / Prof. B. König
3. Synopsis:	The module covers the completion of the master thesis and the regular participation in the work group seminar offered by the supervisor of the master thesis. During the master thesis the student will work on a topic in chemistry, pharmacy or a related scientific discipline under supervision, but mostly on his own, using scientific methods. Topic and methods will be matched with the supervisor of the master thesis. In the work group seminar current research topics of the group will be reported and discussed. The student will report at least once on the results of his master thesis. The module serves to train the completion of a scientific work on one's own and guides to research on one's own authority.
4. Competences Acquired:	The student is able to plan and carry out the work on a scientific problem in chemistry or a related natural science on his own. He has deepened capabilities in literature research and analysis, planning and analysis of experiments as well as writing down a scientific paper.
5. Prerequisites for Participation:	
a) Recommended:	Knowledge in chemistry obtained in a previous basic study of chemistry or a related course of studies. Knowledge in the fields of the modules taken so far in the course of studies (MHE-MSc-M 01 – MCH-MSc-M 05)
b) Compulsory Certificates: to be submitted instantly <input type="checkbox"/> to hand in till end of 4. semester in major <input checked="" type="checkbox"/>	At least two basic modules completed (to be chosen from CHE-MSc-M 01 – CHE-MSc-M 03), one of them in the field the master thesis is completed in Advanced module MCH-MSc-M 04 completed
6. Module Accepted in:	M.Sc. Medicinal Chemistry
7. Module Start:	Every semester
8. Module Duration:	2 semesters
9. Recommended Semester in Major:	3. and 4. semester in major

10. Total workload of the module / credit points:	990 hours/ 33 credit points* (480 h attendance time, 510 h home study)
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*The CP for the module will not be awarded before the final module exam or all parts of the module exam have been passed.

11. Courses:					
	<i>P / WP / W *</i>	<i>Type of course</i>	<i>Topic</i>	<i>Required time of attendance in SWS o. h.</i>	<i>Deliverables</i>
1	P		Master thesis		Master thesis (graded)
2	P	S	Work group seminar	4	Talks on current research during the Master thesis
Remarks:					

* P = required course; WP = elective compulsory course; W = elective course

12. Module Grade:		
<input type="checkbox"/>	The module grade is given by the grade obtained in the final module exam.	
<input checked="" type="checkbox"/>	The module grade is calculated as follows:	
	Grade of the Master thesis	100 %
<input type="checkbox"/>	The module will not be graded	

13. Others:
