



Module Compendium

for the Master's Degree Program Master of Science

Biomedical Sciences (BMS)

Valid as of October 2024

Faculty of Life Sciences

Study programme director: Prof. Dr. Dr. Isabel Burghardt

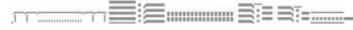






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1. Preliminary remarks

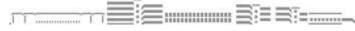
This module compendium serves the purpose of providing students and instructors a detailed and comprehensive description of the curriculum of the degree program Master of Biomedical Sciences.

The module descriptions present the module goals and intended results of study as well as the contents of the individual courses. Furthermore, all information necessary for academic success is given in the module descriptions. They are also included in the diploma supplement to the master's degree program.

If you have any questions regarding several modules or the course of studies, please contact the office of the Dean of the Faculty of Life Sciences.

If you have questions regarding a particular module, please contact the responsible module coordinator. You will find a list of the module coordinators in the Internet, where this module compendium can also be found.

If you have questions regarding a particular course, please contact the instructor.







2. Introduction

The curriculum of the master degree program for Biomedical Sciences comprises 3 semesters. The diploma is a professional qualification and enables graduates of biomedicine with a master's degree in natural science to work in industry or in academia.

Important structural elements of the course of studies are

- Two mandatory modules and four out of five elective modules in the winter term
- Project-oriented learning with 20 ECTS in the summer term
- Two out of three elective modules in the summer term
- A master's thesis, to be written within 6 months during the third semester.

The curriculum has been chosen so that graduates will be qualified to work in various fields, in particular in academic and industrial research in pharmaceuticals, medical technology (implants, regenerative medicine), biotechnology and diagnostics. The graduates' qualifications will be based on their education in the modern fields of material and surface sciences with regard to their application in biomedicine, but also on a profound knowledge of bioanalytics, pharmaceutical research and modern biotechnology. Students can start their studies both during winter or summer semester.

Modules in the winter term comprise two mandatory modules:

- Statistics in Biomedicine (BMSM01)
- Scientific methods (BMSM02)

These modules provide fundamental knowledge in the field of biomedical science.

In addition, also in the **winter semester, five modules** covering various fields in biomedical sciences are presented, of which **four modules are to be selected:**

- Analytical Methods in Biomedical Sciences" (BMSW03)
- Materials and Applications in Biomedical Sciences" (BMSW04)
- Microbiology & Virology (BMSW05)
- Technology Management" (BMSW06)
- Industry-Related Topics 2 (BMSW07).







In the **summer term**, the main focus is laid on the **mandatory** module

Project-Oriented Learning (BMSM12),

This module provides 20 ECTS. Objective is the education of the students in setting-up, planning and performing a project aiming at the solution of a specific research question.

Additionally in the summer term, three modules are offered, of which two modules must be selected:

- Biofabrication & Regenerative Medicine (BMSW08)
- Advanced Pharmacology (BMSW09)
- Industry-Related Topics 1 (BMSW10)

The master's thesis shall be written in the third semester and can be done internally at Reutlingen University or at an external institute.

European Credit Transfer and Accumulation System (ECTS)

The Ministry for Science, Research and Art BW and the Conference of Ministers of Culture require the curriculum of study to be divided into modules. Students' performance is recorded by means of the "European Credit Transfer and Accumulation System" (ECTS). In order to compare the performance of students at various institutions of higher learning—also foreign institutions—the ECT system is based not on the number of course hours per week, but rather on the time that students are required to invest in learning. In this way, student performance can be more objectively compared throughout Europe.

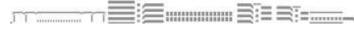
Full-time students can achieve 60 ECTS credit points per academic year. This approximates an average workload of 1800 hours of study. A credit point corresponds to 30 hours workload for a student of average intelligence and aptitude, whereby the workload includes the time during which the student attends class and his/her study time outside of class. Class time is given as weekly number of hours (à 60 minutes) per course (WH).

Example

WH*	Class attendance	Study time	Workload	Credit points
2	30h	60h	90h	3

WH* = 1 WH equals 15 hours per semester, which normally consists of 15 weeks.

Students can only obtain the ECTS points if the required exams have been successfully and verifiably absolved. Credit points are awarded according to the "all or none" principle.



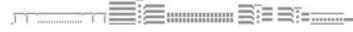




3. Overview of the modules in the course of studies

Module	Courses	* W/S	** M/E	WH	ECTS
BMSM01: Statistics in	1.1: Medical Statistics	w	М	2	5
Biomedicine	1.2: Multivariate Data Analysis	, vv	141	2	3
BMSM02: Scientific Methods	2.1: Quantitative Biology	w	М	2	5
DIVIDIVIUZ. SCIENLING WIELHOUS	2.2: Research Design	l vv		2	3
BMSW03: Analytical Methods	3.1: Analytical Methods in Biomedical Sci.	w	E	2	5
in Biomedical Sciences	3.2: Diagnostic Technologies	l vv	_	2	5
BMSW04: Materials and	4.1.: Functional Implants & Surface Technologies	W	Е	2	5
Applications in Biomedical Sci.	4.2: Drug Research and Delivery Systems	l vv	_	2	5
BMSW05: Microscopy and	5.1: Microscopy and Optics	w	Е	2	5
Microbial / Viral Pathogens	5.2: Microbial / Viral Pathogens and Infection	l vv	E	2	5
BMSW06: Technology	6.0: Innovation M/QM/Project M	w	E	4	5
Management		VV	E	4	5
BMSW07: Industry-Related	7.1: Drug Discovery & Development	w	E	2	5
Topics 2	7.2: Introduction into Medical Technology	VV		2	5
BMSW08: Biofabrication &	8.0 Biofabrication & Regenerative Medicine	S	١	4	-
Regenerative Medicine		5	E	4	5
BMSW09: Advanced	9.1: Biomedical Pharmacology	S	١	2	-
Pharmacology	9.2: Advanced Bioanalysis	5	E	2	5
BMSW10: Industry-Related	10.1: Regulatory Affairs		-	2	-
Topics 1	10.2: IP Management	S	E	2	5
BMSW11: Modules from other	11.0: Modules from other Schools or Universities		-	4	-
Schools or Universities		S	E	4	5
BMSM12: Project Oriented	12.1: Information Retrieval and Evaluation			2	
Learning	12.2: Research Seminar	S	М	2	20
	12.3. Team Project			12	
BMSM13: Master's Thesis	13.1: Master's Thesis Project and Defense	3	N A	-	20
	13.2: Research Seminar	3	М	2	30
BMSW14: Internship semester	14.0: Internship semester				
(Add. Module only for stud.		W/S	Ε	-	30
with 180 ECTS BSc's degree)					

^{*} Semester: W (Winter) / S (Summer)



^{**}Type: M (Mandatory) / E (Elective)





4. Assignment of Marks / Assessment of Quality

Relative ECTS Marks

The international standard foresees that the best 10% of those students who pass receive the mark "A", regardless of which mark they may receive according to the German marking system. With this system, the performance of students who have passed can be compared more objectively, taking into account that different courses may have different degrees of difficulty.

Student performance	ECTS mark
the best 10%	A = excellent
the next 25%	B = very good
the next 30%	C = good
the next 25%	D = satisfactory
the next 10%	E = sufficient
	F = failing

Since a large number of students are necessary in order to correctly calculate the relative ECTS marks, the conventional German marking system (1-5) shall be used and adapted as shown in the table below (valid as of February 2011).

ECTS mark	German mark	ECTS definition	German translation
Α	1,0 - 1,3	excellent	hervorragend
В	1,4 - 2,0	very good	sehr gut
С	2,1 - 2,7	good	gut
D	2,8 - 3,5	satisfactory	befriedigend
E	3,6 - 4,0	sufficient	ausreichend
FX/F	4,1 - 5,0	failing	nicht bestanden





5. Module description

Remarks Concerning the Description of Modules

The module descriptions are meant to offer students information regarding the course of studies, curriculum content, qualitative and quantitative requirements, the relationship of the individual modules to other modules and integration of the module into the general concept of the course of studies. The module descriptions are listed in tabular form.

The following remarks will help the reader to understand the terms used in the module descriptions. Module description / abbreviation:

A module name and abbreviation have been assigned to every module. The module name provides information about the content of the module. The corresponding abbreviation begins with the first letter of the name of the degree program. It ends with a number of a sequence of numbers. Thus, the abbreviation BMSM1 stands for the first module in Biomedical Sciences (the second "M" stands for "Mandatory", "W" stands for "Elective" = "Wahlpflichtmodul").

Courses:

The courses included in a module are listed separately.

Semester:

The semester in which a module must be absolved is indicated.

Person responsible for the module:

This person is responsible for the editing of the module.

Instructor:

Instructors are responsible for the content and organization of their courses and/or those courses, which are held by an associate instructor.

Language:

The language in which the course is taught is indicated.





Integration with other courses of study:

In the event that a module is also offered in other courses of study, this shall be indicated.

Type of instruction/WH:

The type of instruction as well as the weekly hours of instruction are indicated in tabular form. The abbreviations stand for:

Lecture (L)

Exercise (E)

Lab work (LW)

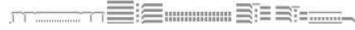
Seminar (S)





BMSM01: Statistics in Biomedicine

Course of studies	Biomedical Sciences (MSc	Biomedical Sciences (MSc)				
Module	Statistics in Biomedicine					
Abbreviation	BMSM01					
Course(s)	Medical Statistics					
	Multivariate Data Analysis	Multivariate Data Analysis (MDA)				
Semester	Winter					
Person responsible for the module	Prof. Dr. Rumen Krastev					
Instructor(s)	Dr. Nadejda Krasteva					
	Prof. Dr. Karsten Rebner					
Language	English / German for MDA course					
Status within the curriculum	Mandatory					
Type of course / WH	Course		L	Е	LW	S
	Medical Statistics		2			
	Multivariate Data Analysis	(MDA)	1	1		
Workload in hours	Course	Class Attendance	Study outside of class		Total	СР
	Medical Statistics	30	45		75	
	Multivariate Data Analysis (MDA)	30	45		75	
	Total	60	90		150	5
Credit points	5		<u> </u>			
Prerequisites for attending this course	See examination regulation	ons				
Recommended knowledge	Fundamentals of mathematics, IT, biology, chemistry, physics					
/ course work	and/or medicine					
Module goals / desired	General knowledge:					
outcome	Ability to think statistically					
	Basic knowledge of statistical methods and					
	multivariate data a	analyses				







	Basic knowledge of principles of experiment design				
	and statistical learning				
	Technical competences:				
	Ability to use databases for simple data retrieval				
	Ability to identify and use appropriate methods in				
	statistics				
	Ability to perform and interpret simple statistical				
	methods and tests				
	Ability to recognize the limitations of statistical tests				
	Ability to develop linear and non-linear regression				
	methods				
	Ability to design new multivariate models for a given				
	data set				
	Ability to describe medical processes statistically				
	Ability to use the knowledge in approval processes for				
	medical devices.				
	Ability to use software tools for statistics, data an				
	image analysis and data visualization				
	Social competences and skills:				
	Ability to research, interpret and present scientific				
	results				
Contant	. Modical and pharmacourtical statistics				
Content	Medical and pharmaceutical statistics Statistics in alinical practice; gathering interpreting				
	Statistics in clinical practice: gathering, interpreting and presenting statistical data from medical studies				
	Design of experiments for drug development,				
	optimization and approval procedures Approval of test				
	hypothesis in clinical studies				
	Multivariate Data Analysis				
	Explorative Data Analysis (EDA); Principal Components				
	Analysis; Statistical Learning and Model Selection;				
	Linear Regression Methods and Regression Shrinkage				
	Methods				



Study and exam requirements	Written exam (2h)				
Media used	PowerPoint slides, flip charts, board, computer, software tools				
Literature	 Statistical methods in medical research, P Armitage, G Berry, J N S Matthews, Blackwell Scientific Publications (Oxford, Boston) 2002 Esbensen, Kim, et al. Multivariate Data Analysis: An Introduction to Multivariate Analysis, Process Analytical Technology and Quality by Design. Camo, 2018. Kessler, W.: Multivariate Datenanalyse für die Pharma- , Bio- und Prozessanalytik, Wiley-VCH, 2007 				





BMSM02: Statistics in Biomedicine

Course of studies	Biomedical Sciences (MSc	Biomedical Sciences (MSc)				
Module	Scientific Methods					
Abbreviation	BMSM02					
Course(s)	Quantitative Biology					
	Research Design	Research Design				
Semester	Winter					
Person responsible for the module	Prof. Dr. Ralf Kemkemer					
Instructor(s)	Prof. Dr. Ralf Kemkemer					
Language	English					
Status within the curriculum	Mandatory					
Type of course / WH	Course		L	Е	LW	S
	Quantitative Biology		1	1		
	Research Design		1	1		
Workload in hours	Course	Class Attendance	Study outside of class		Total	СР
	Quantitative Biology	30	45		75	
	Research Design	30	45		75	
	Total	60	9	00	150	5
Credit points	5	l				
Prerequisites for attending this course	See examination regulation	ons (Studien-	und F	rüfun	gsordn	ung)
Recommended knowledge / course work						
Module goals / desired	General knowledge:					
outcome	Successful students will obtain					
	Overview of how to use relevant literature data bases					
	with respect to scientific publications, patents,					
	reviews, and mone	ographs				





	 Understanding of how search engines and citation management programs function and can be used Basic understanding of scientific institutions, scientific methods and history of science Knowledge of principles of good scientific practice Understanding of important concepts of research, e.g. hypothesis definition, literary research, planning of experiments, evaluation of experiments and data presentation Understanding of science funding and scientific writing 				
	Skills:				
	Successful students will be able				
	to conduct systematic and efficient scientific literature				
	searches (source identification and exploitation)				
	to efficiently evaluate and document relevant				
	publications and text/content therein				
	to cite literature correctly according to respective scientific standards and to save citations using citation				
	managers • Understanding of advantages disadvantages and				
	 Understanding of advantages, disadvantages and limitations of scientific methods 				
	Ability to design a basic research project and write a				
	proposal therefore				
	Ability to plan a research project				
	Social competences:				
	Ability to work in a self-organized manner and as a				
	member of a team				
	Ability to do work target-oriented and systematically				
Content	Quantitative Biology				
	Research Design				
	Principles of scientific methods and history				
	Structure and organization of German and				
	international scientific institutions				





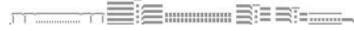
	Principles of science funding				
	Principles of scientific research and literary research				
	with practical examples				
	Aspects of a scientific project (hypothesis, planning,				
	research, financing, data evaluation,)				
	Scientific writing (proposals, publications), review				
	process				
Study and exam requirements	Presentation, assignments, proposal				
Media used	Lecture, board, overheads, lecture notes, handouts, exercise				
Media used	Lecture, board, overheads, lecture notes, handouts, exercise sheets, software practicals in CIP-pool				
Media used Literature					
	sheets, software practicals in CIP-pool				
	 sheets, software practicals in CIP-pool Research Methods for the Biosciences, 2nd Edition, D. 				





BMSW03: Analytical Methods in Biomedical Sciences

Course of studies	Biomedical Sciences (MSc)					
Module	Analytical Methods in Biomedical Sciences					
Abbreviation	BMSW03					
Course(s)	Analytical Methods in Biomedical Sciences					
	Diagnostic Technologies					
Semester	Winter					
Person responsible for the module	Prof. Dr. Günther Proll					
Instructor(s)	Prof. Dr. Jörg Mittelstät					
	Prof. Dr. Günther Proll					
Language	English					
Status within the curriculum	Elective module					
Type of course / WH	pe of course / WH Course		L	Е	LW	S
	Analytical Methods in Biomedical Sciences					1
	Diagnostic Technologies		2			
Workload in hours	Course	Class Attendance	Study outside of class		Total	СР
	Analytical Methods in Biomedical Sciences	30	45		75	
	Diagnostic Technologies	30	45		75	
	Total	60	90		150	5
Credit points	5				ı	
Prerequisites for attending this course	See examination regulation	ns				
Recommended knowledge	Knowledge of biochemistry, bioanalytics, instrumental					
/ course work	analytics, chemistry, material science, biology					
Module goals / desired	General knowledge:					
outcome	Successful students will obtain					
	Profound overview of current bioanalytical techniques					
	that are significant in biomedical and pharmaceutical					
	research					





•	Profound	understanding	of	materials	for	diagnostic
	applicatio	ons				

- Profound understanding of technologies and functioning of laboratory diagnostics, point-of-care testing and applications
- Fundamental understanding of principles of cell biology, and molecular biology

Skills:

- Understanding of complex relationships in bioanalytics
- Understanding of the aspects of -OMICS that are relevant for R&D in biotechnology, pharmaceutical and diagnostics industries
- Understanding of principles of interaction of biological systems and molecules with materials
- Understanding of principles of structure of diagnostic systems and prerequisites for certain applications
- Ability to name limitations of existing technologies
- Ability to evaluate various methods of laboratory diagnostics
- Ability to read and understand scientific publications

Social competences:

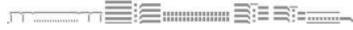
- Ability to prepare and deliver a scientific presentation for a seminar
- Ability to do scientific research and to present scientific findings

Content

Analytical Methods in Biomedical Sciences

The course consists of a lecture and a seminar. Students must choose a research topic on which they will prepare and hold a scientific presentation. The following fields of study will be covered in the lecture and seminar:

- Biomarkers
- Proteomics and metabolomics
- Pharmaceutical analysis







	Selected topics of bioanalysis e.g, high content bioimaging collemins enigenemies.							
	bioimaging, cellomics, epigenomics							
	Diagnostic Technologies							
	Structure, function and application of laboratory diagnostic							
	methods, in particular micro-technologies and microfluidics,							
	lab-on-a-chip technology, Bio-MEMS, point-of-care testing,							
	personalized medicine, companion diagnostics, Al in							
	diagnostics							
Study and exam requirements	Written exam (2h), presentation, term paper							
Media used	Lecture, script as download, board, student presentations,							
	digital projector, handouts							
Literature	Jens Kurreck, Joachim W. Engels, Friedrich Lottspeich,							
	Bioanalytik, Springer-Verlag GmbH Berlin 2022							
	Albert Folch, Introduction to BioMEMS, CRC Press							
	(2013)							
	Peter Luppa, POCT - Patientennahe Labordiagnostik,							
	Springer (2017)							
	Strachan T, Read AP, Matson RS, Human Molecular							
	Genetics, CRC Press (2018).							
	Barh D, Blum K, Madigan MA, OMICS - Biomedical							
	Perspectives and Applications, CRC Press (2012)							
	Rehm, H., Letzel, T.: Der Experimentator –							
	Proteinbiochemie/Proteomics, Spektrum Verlag							
	Scientific publications							





BMSW04: Materials and Applications in Biomedical Sciences

Course of studies	Biomedical Sciences (MSc)						
Module	Materials and Applications in Biomedical Sciences						
Abbreviation	BMSW04						
Course(s)	Functional Implants & Surface Technologies						
	Drug Release and Delivery	y Systems					
Semester	Winter						
Person responsible for the module	Prof. Dr. Rumen Krastev						
Instructor(s)	Prof. Dr. Rumen Krastev						
	Dr. Xin Xiong						
Language	English						
Status within the curriculum	Elective module						
Type of course / WH	Course		L	Е	LW	S	
	Functional Implants & Surface Technologies						
	Drug Release and Delivery Systems 2						
Workload in hours	Course	Class Attendance	Study Total outside of class			СР	
	Functional Implants & Surface Technologies	30	4	-5	75		
	Drug Release and Delivery Systems	30	4	·5	75		
	Total	60	9	0	150	5	
Credit points	5		1		1		
Prerequisites for attending this course	See examination regulation	ons					
Recommended knowledge	Basic understanding (BSc	-level) of che	emistry	, biolo	ogy and		
/ course work	biomedical technology, ma	aterial sciend	ces				
Module goals / desired	General knowledge:						
outcome	Knowledge of ma	terials for bi	omedi	ical ap	oplication	on in	
	in- vitro and in-vivo	o application	S				
	 Understanding 	of techno	ologies	s fo	r su	rface	
	modifications for i	mplants and	relate	ed me	thods		





- Knowledge of biomedical implant technologies - application examples and challenges
- Understating of drug delivery concepts and application of polymers
- Understanding of drug release methods, kinetics and applications

<u>Technical competences:</u>

- Students will be able to understand surface and polymer chemistry technologies and transfer these to appropriate applications in the biomedical field
- Students will be able to identify technical working principles of complex implants
- Students will be able to understand the complexity of tissue-material interaction and relate this to material properties
- Students will be able to classify the suitability of different materials classes for specific applications
- Students will be able to name limitations of current technologies in the field

Social competences:

- Students develop skills in research, reading and interpretation of scientific texts
- Students gain an awareness of ethical aspects in the development of medical products.

Content

Functional Implants & Surface Technologies

Materials and design principles of passive and active implants, examples and applications, surfaces and surface modifications, technical principles of active implants (examples), micro and nanotechnology, surface chemistry, interaction of cells with materials.

Drug Release and Delivery Systems

 Approaches, formulations, technologies, and systems for transporting of active pharmaceutical compounds as needed to achieve the desired therapeutic effect





	Release based on diffusion, degradation, swelling, and
	affinity-based mechanisms
	 Immobilization and delivery of "biologicals" e.g.
	peptides, proteins, antibodies, vaccines and gene
	therapie
	Current approaches – site and time specific targeting,
	facilitated pharmacokinetics
	Example techniques – thin polymer film delivery,
	acoustic or light targeted delivery, liposomal delivery.
Study and exam requirements	Written exam (2h), presentation /assignments
Media used	PowerPoint slides, flip charts, board
	·
Literature	Saber AminYavari (ed.) - Surface Engineering of
	Biomaterials MDPI Press 2020
	Tasaltin N; P.S. Nnamchi (Eds.) Advanced Functional
	Materials MDPI Press 2020
	King M.R.: Principles of Cellular Engineering –
	Understanding the Biomolecular Interface, Academic
	Press, 2006
	Ritter A.B., et al.: Biomedical Engineering Principles,
	CRC Press, 2012
	Narayan R.: Biomedical Materials, Springer Publisher,
	2009 Ratner B.D. et al.: Biomaterial Sciences, Elsevier
	Oxford, 2012
	Wintermantel E., H. Suk-Woo Ha: Medizintechnik: Life
	Science Engineering, Springer 2009
	Drug delivery: Fundamentals and Applications, CRC
	Press, 2017, Edited By Anya Hillery, Kinam Park, , ISBN
	9781482217711
	Drug Delivery: Principles and Applications, edited by
	Binghe Wang, Longqin Hu, Teruna J. Siahaan. Wiley,
	2016. ISBN: 978-1-118-83336-0





BMSW05 - Microscopy and Microbial / Viral Pathogens

Course of studies	Biomedical Sciences (MSc)							
Module	Microscopy and Microbial / Viral Pathogens							
Abbreviation	BMSW05							
Course(s)	Microscopy and Optics							
	Microbial / Viral Pathogen	s and Infecti	ion					
Semester	Winter	Winter						
Person responsible for the module	Prof. Dr. Günther Proll							
Instructor(s)	Prof. Dr. Günther Proll							
	Dr. Doğan Doruk Demircioğlu							
Language	English and German							
Status within the curriculum	Elective module							
Type of course / WH	Course	L	E	LW	S			
	Microscopy and Optics							
	Microbial / Viral Pathogen Infection	s and	2					
Workload in hours	Course	Class Attendance	outs	udy ide of ass	Total	СР		
	Microscopy and Optics	30	4	.5	75			
	Microbial / Viral Pathogens and Infection	30	4	.5	75			
	Total	60	9	0	150	5		
Credit points	5		ı					
Prerequisites for attending this course	None							
Recommended knowledge	Basic understanding of pr	nysics, micro	biolog	y, bioc	hemist	ry		
/ course work	(BSc level)							
Module goals / desired	Microscopy and Optics							
outcome	Students have a detailed knowledge of geometrical							
	and ray optics (K1)							

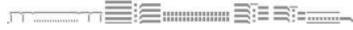




- Students understand the formation of images by Basic understanding of physics, microbiology, biochemistry (BSc level) lenses (K2)
- Students understand the difference between geometrical and wave optics (K2)
- Students are able to solve problems of intermediate complexity (K3)
- Students are able to construct images formed by a simple lens system (e.g. a microscope) (K3)
- Students have a profound knowledge of the most relevant microscopic techniques (K1)
- Students are able to assign a problem to the most relevant microscopy techniques (K4)
- Students are able to analyze a given microscopy technique and find out the most relevant relations (K4)
- Students create and give an oral presentation about a microscopic technique for other students (K6)

Microbial / Viral Pathogens and Infection

- Students can classify viruses and bacteria into categories.
- Based on the cellular structure of bacterial cell walls, they can classify bacteria.
- They understand the mechanisms of infection pathways.
- Students are able to describe different toxins and explain their effects on humans.
- They know the importance of vaccinations in preventing infectious diseases and understand the mechanisms of immunization.
- They have learned the basics of epidemiology.
- They are able to identify different techniques for inactivating pathogens and apply them to examples.







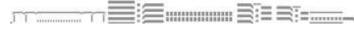
Content

Microscopy and Optics

- Optical technologies are a cornerstone of many analytical technologies. The lecture begins with a brief review of geometrical optics. We discuss wave optics in free space and look at aberrations of optical elements, lens design and technical optics.
- In the second part, we focus on microscopy and discuss the resolution of a conventional microscope, as well as fluorescence microscopy and the confocal microscope. Furthermore, the methods TIRF and FRET, as well as methods for resolution enhancement such as structured illumination, 4Pi, STED, STORM and FLIM microscopy are discussed.
- Furthermore, resolution enhancements through software solutions as well as automated microscopy techniques and Al-based approaches are discussed.
- Examples of applications are given in all parts.

Microbial / Viral Pathogens and Infection

- Students will understand the fundamentals of microbiology/virology, including viral and bacterial taxonomy, metabolism etc.
- Students will understand basic concepts of Microbial Genetics
- Students will understand what a disease is, what causes a disease and how the human immune system clears an infectious disease
- Students will understand the enormous and diverse impact of microbiota/the microbiome on humans
- Students will understand the importance of vaccinations for the prevention of infectious diseases caused by Gram-negative or positive pathogens or viruses and understand the underlying mechanism of immunization





	Students will learn how antibiotics work, why AMR is a					
	global health concern and how to tackle it					
	Students will get an overview of virus biology and					
	antiviral chemotherapy					
Study and exam requirements	Written exam (2h), presentation					
Media used	Lecture, board, digital projector, handouts					
Literature	Hecht, E.: Optics, Addison-Wesley, 2001					
	Murphy, D.B.: Fundamentals of Light Microscopy and					
	Electronic Imaging, Wiley-Blackwell; 2nd ed. 2012					
	Jens Kurreck, Joachim W. Engels, Friedrich Lottspeich,					
	Bioanalytik, Springer-Verlag GmbH Berlin 2022					
	Modrow, S.; Molekulare Virologie; Spektrum					
	Akademischer Verlag, 2022					
	Allgemeine Mikrobiologie, Thieme, 2021					
	Brock Microbiology of Microorganisms, Global Edition,					
	2021					
	Jane Flint, Vincent R. Racaniello et al.: Principles of					
	Virology, 2020					
	Scientific publications					





BMSW06: Technology Management

Course of studies	Biomedical Sciences (MSc)						
Module	Technology Management						
Abbreviation	BMSW06						
Course(s)	Project Management						
	Innovation Management						
Semester	Winter						
Person responsible for the module	Prof. Dr. Andreas Kandelbauer						
Instructor(s)	Prof. Dr. Andreas Kandelbauer						
	Dr. Xin Xiong						
	Dr. Andreas Paar						
Language	English						
Status within the curriculum	Elective module						
Type of course / WH	Course			E	LW	S	
	Project Management		2				
	Innovation Management		2				
Workload in hours	Course	Class Attendance	outs	udy ide of ass	Total	СР	
	Project Management	30	4	.5	75		
	Innovation Management	30	4	.5	75		
	Total	60	9	0	150	5	
Credit points	5		I				
Prerequisites for attending this course	See examination regulation	ns					
Recommended knowledge / course work	Basic understanding of pro	oject manag	ement	t			
Module goals / desired	Project Management:						
outcome	Ability to understa	nd and use	the pr	inciple	es of pr	oject	
	management pri	nciples in	mana	ging	a rese	earch	
	project (time and costs).						
	Ability to successfully lead a team.						



	Innovation Management:				
	 Understanding of innovation strategies and processes. 				
	Understanding of the significance of the context of				
	innovation strategy for the daily business of				
	researchers in an R&D organization.				
	Ability to apply quality and quantitative evaluation				
	methods in projects.				
Content	Innovation Management:				
	Economic relevance of innovation				
	Innovation strategies				
	Innovation processes				
	Open innovation				
	Project management:				
	Time and cost planning of projects				
	Portfolio management				
	Scientific and financial evaluation of research projects				
	High-performance teams				
Study and exam requirements	Written exam (2h)				
Media used	Lecture, group work, interactive discussions, handouts,				
	flipcharts				
Literature	Gassmann O. et al. (2004) Leading Pharmaceutical				
	Innovation. Springer Verlag				
	Schein EH (1997) Organizational Culture and				
	Leadership. Jossey-Bass Publishers				
	S. Nokes and S. Kelly. Guide to Project Management.				
	FT Press (2003)				
	PMI (2008) The Standard for Portfolio Management.				
	2nd edition. Project Management Institute				
	Alexander Schuhmacher, Markus Hinder, Oliver				
	Gassmann (2015) Value Creation in the				
	Pharmaceutical Industry: The Critical Path Towards				
	Innovation, Wiley International				





BMSW07: Industry-Related Topics 2

Course of studies	Biomedical Sciences (MSc)					
Module	Industry-Related Topics 2					
Abbreviation	BMSW07					
Course(s)	Drug Discovery & Develop	ment				
	Introduction into Medical	Technology				
Semester	Winter					
Person responsible for the module	Prof. Dr. Jörg Mittelstät					
Instructor(s)	Prof. Dr. Jörg Mittelstät					
	Dr. Andreas Schüle					
Language	English					
Status within the curriculum	Elective module					
Type of course / WH	Course			Е	LW	S
	Drug Discovery & Development		2			
	Introduction into Medical Technology					
Workload in hours	Course	Class Attendance	Study outside of class		Total	СР
	Project Management	30	45		75	
	Innovation Management	30	4	5	75	
	Total	60	90		150	5
Credit points	5					
Prerequisites for attending this course	See examination regulation	ons				
Recommended knowledge	Basic understand	ing, knowled	lge of	the p	rinciple	es of
/ course work	pharmaceutical and medical technology industries					
	Basic knowledge of natural sciences					
	Basic knowledge of the pharmaceutical and medical					
	technology industr	ries				





Module goals / desired outcome

Understanding of strategic and operational topics concerning drug discovery, drug development, medical and biomedical technologies.

In "Drug Discovery and Development", students will receive information on state-of-the-art developments, research, and expert opinions in the pharmaceutical industry. Furthermore, the key success factors in research and development (R&D) as well as value creators in pharmaceutical innovation will be discussed. The topics addressed include the innovation process, pharmaceutical R&D, research and innovation strategies. Students will gain an overview of the pharmaceutical industry and how pharmaceutical R&D works operationally.

In the "Introduction to Medical Technology", students will gain a basic understanding of fundamental technologies in biomedical engineering, focusing on the medical background and basic principles of related methods (MRT, CT, sonography, PET, dialysis, heart-lung machine, artificial lungs, stents, heart valves, pace makers).

Students will know:

- the definition of biomedical engineering and
- the basic principles and medical background of different technologies.

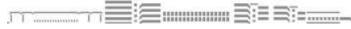
Thus, students will improve their ability to

- understand and use new vocabulary
- · read, summarize and discuss scientific topics and
- prepare and present scientific results in the form of short presentations in teams.

Content

Drug Discovery and Development

- Global epidemiology
- Pharma-economics
- Financing of innovation
- Drug targets
- Preclinical safety







	Pharmaceutical development			
	Translational medicine			
	Clinical development			
	Biologics and ATMPs			
	Bioequivalence and Biosimilars			
	Regulatory considerations			
	Pharmaceutical strategies			
	Introduction to Medical Technologies			
	Introduction			
	Definition			
	Overview			
	Short summary of the basics			
	Medical background and technology fundamentals: Medical			
	imaging			
	• MRT			
	• CT			
	 Sonography 			
	• PET			
	• etc.			
	Life support systems			
	• Dialysis			
	Heart-lung machine			
	Artificial lung			
	• etc.			
	Implants			
	Stent			
	Heart valve			
	Cochlear			
	Retinal			
Study and exam requirements	Preparation and presentation of at least one scientific topic in			
	the module; written examination (2 hours)			
Media used	Lecture, group work, interactive discussions, handouts, flip			
	charts			
<u> </u>				







Literature	Blass BE, Basic Principles of Drug Discovery and
	Development,2nd Edition, Elsevier Academic Press,
	2021
	Hill RG, Richards DB, Drug Discovery and Development
	– Technology in Transition, 3rd Edition, Elsevier.
	• Wintermantel, E., Ha, S. W.: Medizintechnik: Life
	Science Engineering. Interdisziplinarität,
	Biokompatibilität, Technologien, Implantate,
	Diagnostik, Werkstoffe, Zertifizierung, Business
	Springer, Berlin; Auflage: 5., überarb. u. erw. A. 2009
	Ratner, B. D., Hoffman A.S. et al. (eds.): Biomaterials
	Science - An Introduction to Materials in Medicine,
	Elsevier Academic Press, 2004
	Joseph Bronzino and Donald R. Peterson : The
	Biomedical Engineering Handbook, Fourth Edition:
	Four Volume Set, Crc Pr Inc; 2015
	Pierre Morgon (2014) Sustainable Development in the

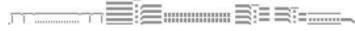
Healthcare System, Springer





BMSW08: Biofabrication & Regenerative Medicine

Course of studies	Biomedical Sciences (MSc)						
Module	Biofabrication & Regenerative Medicine						
Abbreviation	BMSW08						
Course(s)	Biofabrication						
	Regenerative Medicine						
Semester	Summer						
Person responsible for the module	Prof. Dr. Petra Kluger						
Instructor(s)	Prof. Dr. Petra Kluger						
Language	English						
Status within the curriculum	Elective module						
Type of course / WH	Course	L	Е	LW	S		
	Biofabrication		1	1			
	Regenerative Medicine		2				
Workload in hours	Course	Class Attendance	outsi	udy ide of ass	Total	СР	
	Biofabrication	30	1	5	75		
	Regenerative Medicine	30	4	5	75		
	Total	60	9	0	150	5	
Credit points	5		1				
Prerequisites for attending this course	See examination regulation	ons					
Recommended knowledge	Cell biology, physiology,	biomateria	ls, tis	sue e	enginee	ering,	
/ course work	biomedical engineering						
Module goals / desired	Students get insight into biofabrication technologies (including						
outcome	bioinks, CAD, automation, different 3D printing methods) for						
	future perspectives in bior	medical engi	neerin	g			







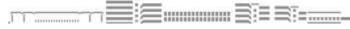
Students get an overview of the materials and techniques used in Regenerative Medicine; state of the art in various clinical applications and the global market

students can:

- define the term biofabrication
- explain basic principles for automation, especially for automated cell and tissue culture as well as clinical applications
- distinguish different biofabrication technologies, their characteristics and their pros & cons
- analyze materials for their use as bioinks and their limitations
- create of digital models by Computer aided design programs and the printing of the self-designed models
- evaluate potential applications of these biofabrication technologies in biomedical sciences
- define the term regenerative medicine
- compare characteristics of stem cells and their clinical use
- analyze different matrix components and their properties as well as the potential clinical applications of different matrices
- explain basic contents of the regulatory framework
- describe key facts concerning the global regenerative medicine market
- evaluate the state of the art in selected applications and the challenges

students improve their ability in:

- understanding and use new vocabulary
- read, summarize, discuss and evaluate scientific topics
- prepare and present results and short presentation in teams







Content	Biomedical Technologies - Biofabrication				
	Introduction Biofabrication				
	Overview of different biofabrication technologies				
	Lab automation for cell and tissue cultures				
	Bioinks for scaffold and tissue fabrication				
	CAD of models and the printing of these files				
	Regenerative Medicine				
	 Definition and short summary of fundamentals 				
	Stem cells (basics and clinical applications)				
	Matrix materials (basics and clinical applications)				
	State-of-the-art clinical applications				
	Regulatory affairs and market				
Study and exam requirements	written examination (2 hours)				
Media used	Lecture, interactive discussions, group work, flip chart, PCs,				
	presentations				
Literature	Gustav Steinhoff, Regenerative Medicine: From				
	, 3				
	Protocol to Patient, Springer 2013				
	, 3				
	Protocol to Patient, Springer 2013				
	Protocol to Patient, Springer 2013 • Anthony Atala, Robert Lanza, James A., Thomson, and				
	Protocol to Patient, Springer 2013 • Anthony Atala, Robert Lanza, James A., Thomson, and Robert M. Nerem, Principles of Regenerative Medicine,				
	 Protocol to Patient, Springer 2013 Anthony Atala, Robert Lanza, James A., Thomson, and Robert M. Nerem, Principles of Regenerative Medicine, Elsevier, 2008 				
	 Protocol to Patient, Springer 2013 Anthony Atala, Robert Lanza, James A., Thomson, and Robert M. Nerem, Principles of Regenerative Medicine, Elsevier, 2008 Ratner, B. D., Hoffman A.S. et al. (eds.): Biomaterials 				
	 Protocol to Patient, Springer 2013 Anthony Atala, Robert Lanza, James A., Thomson, and Robert M. Nerem, Principles of Regenerative Medicine, Elsevier, 2008 Ratner, B. D., Hoffman A.S. et al. (eds.): Biomaterials Science - An Introduction to Materials in Medicine, 				
	 Protocol to Patient, Springer 2013 Anthony Atala, Robert Lanza, James A., Thomson, and Robert M. Nerem, Principles of Regenerative Medicine, Elsevier, 2008 Ratner, B. D., Hoffman A.S. et al. (eds.): Biomaterials Science - An Introduction to Materials in Medicine, Elsevier Academic Press, 2004 				

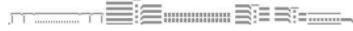






BMSW09: Advanced Pharmacology

Course of studies	Biomedical Sciences (MSc)					
Module	Advanced Pharmacology					
Abbreviation	BMSW09					
Course(s)	Biomedical Pharmacology					
	Advanced Bioanalysis					
Semester	Summer					
Person responsible for the module	Prof. Dr. Jörg Mittelstät					
Instructor(s)	Prof. Dr. Jörg Mittelstät					
	Prof. Dr. Günther Proll					
Language	English					
Status within the curriculum	Elective module					
Type of course / WH	Course		L	Е	LW	S
	Biomedical Pharmacology					
	Advanced Bioanalysis		2			
Workload in hours	Course	Class Attendance	outs	udy ide of ass	Total	СР
	BiomedicalP	30		.5	75	
	harmacology					
	Advanced Bioanalysis	30	4	.5	75	
	Total	60	9	0	150	5
Credit points	5	<u>I</u>				
Prerequisites for attending this course	See examination regulations					
Recommended knowledge	Knowledge of biochemistry, bioanalytics and instrumental					
/ course work	analytics, biology, fundamentals of pharmacology					
Module goals / desired	General knowledge:					
outcome	Profound overview of current bioanalytical techniques					
	relevant for biomedical as well as pharmaceutical					
II	research					







	Understanding of mode of action of drugs				
	<u>Skills:</u>				
	• Understanding of drug interaction in the human				
	organism				
	• In-depth knowledge of Pharmaco-kinetics and				
	Pharmaco- dynamics				
	Understanding of the use of modern analysis systems				
	and biosensors in drug development and personalized				
	medicine				
	 Understanding of the functioning of microarray- 				
	systems and multiplexing				
	 Ability to read and understand scientific publications 				
	Social competences:				
	 Preparation and presentation of a scientific 				
	presentation for a seminar				
	Ability to do scientific research and present scientific				
	findings				
Content	Analytical Methods in Biomedical Sciences				
	Special instrumental analysis				
	Imaging methods				
	• Biosensors				
	Characterization of viral vectors				
	In silico analysis				
	Automation in drug discovery				
	Effect-directed analytics				
	Biomedical Pharmacology				
	Fundamentals and Nomenclature in Pharmacology The state of th				
	Pharmacokinetics				
	Pharmacodynamics				
	Pharmacology of Thrombosis				
	Pharmacology of Hypertension				
	Pharmacology of Pain and inflammation				



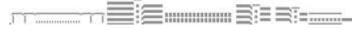
Study and exam requirements	written examination (2 hours)	
Media used	Lecture, script for download, board, digital projector,	
	handouts	
Literature	Jens Kurreck, Joachim W. Engels, Friedrich Lottspeich,	
	Bioanalytik, Springer-Verlag GmbH Berlin 2022	
	Karl Cammann, Instrumentelle Chemie, Spektrum	
	Akademischer Verlag GmbH (2001)	
	• Günter Gauglitz, David S. Moore, Handbook of	
	Spectroscopy, Wiley-VCH Verlag GmbH & Co. KGaA	
	(2010)	
	Ullmann`s Encyclopedia of Industrial Chemistry, Wiley-	
	VCH Verlag GmbH & Co. KGaA (2016)	





BMSW10: Industry-Related Topics 1

Course of studies	Biomedical Sciences (MSc)					
Module	Industry-Related Topics 1					
Abbreviation	BMSW10	BMSW10				
Course(s)	Regulatory Affairs					
	IP Management					
Semester	Summer					
Person responsible for the module	Prof. Dr. Andreas Kandelba	uer				
Instructor(s)	Prof. Dr. Andreas Kandelba	uer				
	Dr. Xin Xiong					
Language	English					
Status within the curriculum	Elective module					
Type of course / WH	Course		L	Е	LW	S
	Regulatory Affairs		2			
	IP Management		2			
Workload in hours	Course	Class Attendance		outside lass	Total	СР
	Regulatory Affairs	30	4	5	75	
	IP Management	30	4	.5	75	
	Total	60	9	0	150	5
Credit points	5	1				
Prerequisites for attending this course	See examination regulation	S				
Recommended knowledge / course work	No specific knowledge requ	ired				
Module goals / desired outcome	The primary goal is to un	derstanding the	strat	egic ar	nd opera	ational
desired outcome	relevance of <u>regulatory aff</u>					
	high-tech industries, such	as the pharma	ceutica	al, biote	echnolog	y and
	medical device industries.					







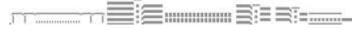
	More specifically, it is the understanding of formalities in the
	development and manufacturing of medical devices and pharmaceutical
	products - with a focus of the respective national and international
	registration and authorization rules.
	In <u>Intellectual Property (IP) Management</u> , students will gain knowledge
	of the international and European patent laws, patentability
	requirements, how to file a patent application and the writing of patent
	claims.
Content	Regulatory affairs
	• FDA
	EMEA, MDR, IVDR
	• ICH
	Development and validation of analytical procedure
	Life cycle regulation, risk and quality management
	<u>IP Management</u>
	European Patent Convention and Patent Cooperation Treaty
	Filing a patent application
	Searching for patents
	Patentability analysis
	Writing patent claims
Study and exam	written examination (2 hours)
requirements Media used	Lecture, script for download, board, digital projector, handouts
Ivicula uscu	Lecture, script for download, board, digital projector, handouts
Literature	The European Patent Convention
	(http://documents.epo.org/projects/babylon/eponet.nsf/0/00
	E0CD7FD461C0D5C1257C060050C376/\$File/EPC_15th_edit
	ion_2013_de_bookmarks.pdf)
	National and international guidelines as accessible via FDA and
	EMEA
	David Mantus & Douglas J. Pisano, FDA regulatory affairs, ISBN-
	- David Maritus & Douglas J. Fisano, FDA regulatory arrains, 10014-
	13:978-1841849195





BMSW11: Modules from other Schools or Universities

Course of studies	Biomedical Sciences (MSc	c)				
Module	Modules from other Schools or Universities					
Abbreviation	BMSW11	BMSW11				
Course(s)	Elective course					
Semester	Summer					
Person responsible for the module	Prof. Dr. Dr. Isabel Burgha	ardt				
Instructor(s)	Instructors from other Sch	nools or Unive	ersitie	S		
Language	English or German					
Status within the curriculum	Elective module					
Type of course / WH	Course		L	Ε	LW	S
	Elective Subject I		2			
	Elective Subject II		2			
Workload in hours	Course	Course Class Study Attendance outside of class		de of	Total	СР
	Elective Subject I	30		5	75	
	Elective Subject II	30	4	5	75	
	Total	60	9	0	150	5
Credit points	5					
Prerequisites for attending this course	See examination regulation	ons				
Recommended knowledge / course work	None					
Module goals / desired outcome	Dependent on elective					
Content	Dependent on elective					
Study and exam requirements	Students must document successful participation in a					
	university course					
Media used	Dependent on elective					
Literature	Dependent on elective					







BMSM12: Project Oriented Learning

Course of studies	Biomedical Sciences (MSc)					
Module	Project Oriented Learning					
Abbreviation	BMSM12					
Course(s)	Information Retrieval and	Information Retrieval and Evaluation				
	Research Seminar					
	Team Project					
Semester	Summer					
Person responsible for the module	Prof. Dr. Dr. Isabel Burgha	ardt				
Instructor(s)	All instructors within the f	aculty				
Language	English and German					
Status within the curriculum	Mandatory					
Type of course / WH	Course		L	Е	LW	S
	Information Retrieval and	Evaluation				2
	Research Seminar					2
	Team Project				12	
Workload in hours	Course	Class Attendance	outs	udy ide of ass	Total	СР
	Information Retrieval and Evaluation	30		·5	75	
	Research Seminar	30	4	·5	75	
	Team Project	180	2	70	450	
	Total	240	30	60	600	20
Credit points	20					
Prerequisites for attending this	For reasons of occupati	ional safety,	the s	studer	nts hav	e to
course	prepare the theoretical a	nd practical	conte	nts of	the mo	dule
	prior to starting practical v	work in the la	borato	ory. Pr	oof of t	his is
	provided by successful participation in a safety and / or					
	introductory colloquium (v	written or ora	l).			





Recommended knowledge / course work	Fundamentals in Chemistry, Physics and Biochemistry		
Module goals / desired outcome	Objective is the education of the students in setting-up, planning		
	and performing a project aiming at the solution of a specific		
	research question.		
	After successful completion of this module students:		
	understand how search engines and citation		
	management programs function and can be used (K2).		
	use relevant literature data bases with respect to		
	scientific publications, patents, reviews, and		
	monographs (K3).		
	conduct systematic and efficient scientific literature		
	searches (source identification and exploitation) (K3).		
	cite and organize literature correctly according to		
	respective scientific standards and to save citations		
	using citation managers (K4)		
	evaluate and efficiently document relevant		
	publications and text/content therein (K5).		
	can define a research project: how to structure		
	complex scientific questions and break them down		
	into single steps like formulating state of the art and		
	formulating scientific hypotheses. (K6)		
	successfully apply tools for practical project planning		
	and coordination (Gantt-diagrams, decision gates,		
	milestones, deliverables, etc.). (K5)		
	 professionally apply tools for practical project 		
	management (action items, meeting organization,		
	work documentation, efficient use of resources,		
	coordination, etc.). (K4)		
	effectively extract information from technical and		
	scientific databases and evaluate it with regard to a		
	specific research question. (K4)		
	gain in-depth knowledge about a specific topic		
	depending on the specified research question. (K3)		





- select the appropriate scientific methodology depending on the specific research question. (K4)
- are able to think conceptually, work beneficial together in project teams and have developed and strengthened their team and communication skills.
 (K5)
- properly present and scientifically sound defense their own findings in front of a panel of experts (= council of supervisors) (K5)
- discuss competently experimental results in the light of the state of the art and comparing own findings to the scientific literature. (K4)
- assimilate to novel research questions, adapt to / orientate in a new field. (K5)
- are able to work in a self-organized manner and as a member of a team and do their work target-oriented and systematically. (K6)

Content

Information Retrieval and Evaluation

- Reference data bases, search engines, citation managers
- Literature search examples/exercises based on concrete scientific questions

Team Project and Research Seminar

The students will work in teams on a defined research question. The research question is defined by the supervisor at the faculty and will be in accordance with current research activities at the department. The students will prepare a scientific and technological state of the art on this research question and based on this they will define a project plan addressing all relevant issues of a real research project (time schedule, resource plan, objectives, means to arrive at the objectives, required methods, hypotheses, etc.). This project plan will be disseminated as a formal project application with a special focus on a comprehensive state of the art. No single-



	person projects are admissible and all projects are hosted by		
	the faculty exclusively. The actual research project plan set up		
	by the students will then be realized. The students will perform		
	the necessary scientific and technological experiments based		
	on the state of the art on this research question and their		
	research proposal. The students organize their project by		
	themselves and are guided by the supervising professor.		
	The project results will be disseminated as a formal final		
	project report. The results will also be presented at a final oral		
	defense in front of a panel of all supervising professors and a		
	poster presentation will be prepared.		
Study and exam requirements	Study requirements: oral presentation of project plan during		
	semester		
	Exam requirements:		
	Written seminar paper (= state of the art) (50%)		
	Final project report (35%)		
	Final project defense (15%), including oral presentation		
	and/or poster presentation		
Media used	Lecture, board, digital projector, handouts		
Literature	Chalmers AF (2007) Wege der Wissenschaft.		
	Einführung in die Wissenschaftstheorie, 6. Auflage,		
	Nachdruck, Springer		
	Patzak G, Rattay G (2004) Projektmanagement, 4.		
	Auflage, Linde International		
	• Baguley P (1999) Optimales Projektmanagement,		
	Falken		
	Scientific Original papers, depending on the specific		
	research question		
	H.F. Ebel et al. (2006) Schreiben und Publizieren in		
	den Naturwissenschaften, Wiley-VCH Weinheim.		
	Others, dependent on topic of research project		





BMSM13: Master's Thesis

Course of studies	Biomedical Sciences (MSc)					
Module	Master's Thesis					
Abbreviation	BMSM13					
Course(s)	Master's Thesis Project ar	nd Defense (intern	al/ ext	ernal)	
	Research Seminar to Mas	ter's Thesis				
Semester	3					
Person responsible for the module	Prof. Dr. Dr. Isabel Burgha	ardt				
Instructor(s)	All instructors within the fa	aculty				
Language	English and German					
Status within the curriculum	Mandatory					
Type of course / WH	Course		L	Е	LW	S
	Master's Thesis Project ar (internal/ external)	nd Defense				
	Research Seminar to Mas Thesis	ter's				2
Workload in hours	Course	Class Attendance	Study Total outside of class		СР	
	Master's Thesis Project and Defense (internal/ external)			40	840	28
	Research Seminar to Master's Thesis	30	3	80	60	2
	Total	240	3	60	600	30
Credit points	30	l				
Prerequisites for attending this course	See examination regulation	ons				
Recommended knowledge / course work	Successful completion of research project					
Module goals / desired	Ability to implement ac	quired resea	arch a	abilitie	es with	in a
outcome	defined research project					
	General knowledge • Ability to do detailed accientific to		•	h rese	earch (on a





<u>Skills</u> Ability to work independently in a team on a defined research project Ability to evaluate and implement insights / findings of scientific literature Ability to prepare and present scientific results <u>Technical competences</u> Ability to apply modern strategies for finding scientific solutions Social competences Ability to promote team work in a research group Content Students will work independently on a defined research project, preferably in a research group at the Reutlingen University or at an external research institute (e.g. NMI at the University of Tübingen or the Fraunhofer Institute in Stuttgart). Students will work under the direction of a professor of our faculty. Their work will culminate in a master's thesis, to be written by each student individually and independently. The thesis work may also be done in an industrial R&D department, provided a professor of the Faculty of Life Sciences supervises the project. Each student will research a defined scientific topic, present his/her findings to a board of experts and prepare a scientific publication of the results. Work on the thesis will be accompanied by regular attendance of seminars on the topic of research. Study and exam requirements Master's thesis: The master's thesis will be evaluated by the mentoring professor as well as by a second reviewer Seminar on topics related to master's thesis: After completing the master's thesis, students will hold an oral presentation on their work



Media used	Oral presentation, written thesis, digital projector, PowerPoint
	slides
Literature	Dependent on research project





BMSW14: Internship semester (Add. Module only for stud. with 180 ECTS BSc's degree)

Course of studies	Biomedical Sciences (MSc	c)				
Module	Internship semester					
Abbreviation	BMSW14					
Course(s)	Internship semester					
Semester	Winter or Summer					
Person responsible for the module	Prof. Dr. Dr. Isabel Burgha	ırdt				
Instructor(s)	All instructors of faculty					
Language	English or German					
Status within the curriculum	Mandatory					
Type of course / WH	Course		L	E	LW	S
	Internship semester					
Workload in hours	Course	Class Attendance	outsi	udy ide of ass	Total	СР
	Internship semester			00	900	30
Credit points	30					
Prerequisites for attending this course	See examination regulations					
Recommended knowledge / course work	Successful completion of	semesters 1	and 2	2		
Module goals / desired	After successful completion	on of this mo	dule:			
outcome	Students have a	profound ins	sight ii	nto th	e struc	ture,
	organization and operations of an industrial company			pany		
	or a research institution. (K2)					
	Students are aware of the independent processing of			ng of		
	specific tasks within projects. (K2)					
	Students are able to determine the status of			s of		
	development / research by literature search. (K4))		
	Students have a	cquired the	skills	for i	ndepen	dent
	implementation of	f projects. (K	4)			



	Ottodantalana wainadika a amanatana fari a adamatika
	Students have gained the competence for a systematic
	and a structured approach. (K5)
	 Students have gained the competence to work
	scientifically. (K6)
	Students have experienced the manners and practices
	in the work environment. (K2)
	• Students have improved their team and
	communication skills through participation in the
	working group. (K3)
	Students interact successfully in intercultural
	surroundings. (K4)
Content	The internship semester is performed in close co-operation
	between the internship site, the student and the internship
	Office of the school of Life Sciences.
	In 24 weeks, interns work on projects in their industrial
	enterprises or their institutions, which are connected to the
	thematic study content of the curriculum.
Study and exam requirements	Continuous assessment, regular reporting, preparation of a
	project report manuscript, certificate of the internship site
Media used	
Literature	Depends on actual project