TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

Compendium of Modules in the Master Program 'Biology'

With the Four Specializations:

Microbial and Plant Biotechnology (MPBiotec)

Molecular Cell Biology (MCB)

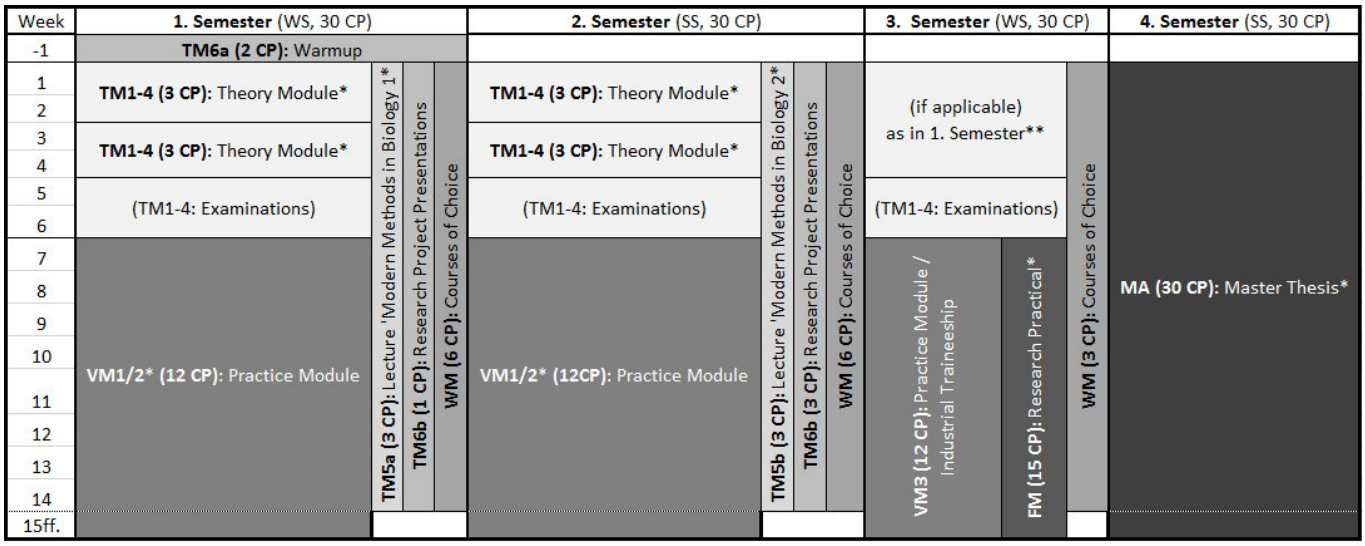
Neurobiology (Neuro)

Ecology (Eco)

General Content of the Master Program 'Biology'

Code	Sem.	Courses	Grade	CP
TM 1-4	1-2	Theory: Lecture and Reading Course	Graded	3
TM 1-4	1-2	Theory: Lecture and Reading Course	Graded	3
TM 1-4	1-2	Theory: Lecture and Reading Course	Graded	3
TM 1-4	1-2	Theory: Lecture and Reading Course	Graded	3
TM 5	1-2	Theory: Lecture 'Modern Methods in Biology'	Graded	6
TM 6	1-2	Theory: Warmup Meeting & Research Project Presentations	Non-graded	6
WM	1-3	Courses of Choice (incl. soft skills)	Non-graded	15
VM 1/2	1-2	Practice: Practical Class	Graded	12
VM 1/2	1-2	Practice: Practical Class	Graded	12
PM/VM 3	3	Practice: Industrial Traineeship or Practical Class	Non-graded	12
FM	3-4	Practice: Research Practical	Graded	15
MA	4	Master Thesis	Graded	30

General Curriculum of the Master Program 'Biology'



*graded

**Not required if done in Semester 1

light gray background = mainly theoretical courses; dark gray background = mainly practical courses

Curriculum of the Master Program 'Biology' with Specialization 'MPBiotec'

Week	1. Semester (WS, 30 CP)				2. Semester (SS, 30 CP)				3. Semester (WS, 30 CP)			4. Semester (SS, 30 CP)
-1	**TM6a (2 CP):** Warmup											
1	**TM1-4 (3 CP):** Mass Spectrometry and Deep Sequencing based Strategies in Systems Biology	**TM5a (3 CP):** Lecture 'Modern Methods in Biology' 1	**TM6b (1 CP):** Research Project Presentations	**WM:** Courses of Choice	**TM1-4 (3 CP):** Plant Biotechnology	**TM5b (3 CP):** Lecture 'Modern Methods in Biology' 2	**TM6b (3 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	(if applicable) as in 1. Semester**		**WM (3 CP):** Courses of Choice	**MA (30 CP):** Master Thesis
2	*or:* Molecular Microbiology											
	or : Genetics, Genomics and Epigenetics				**TM1-4 (3 CP):** Plant Acclimation (SFB)							
3	**TM1-4 (3 CP):** Fundamental Concepts and Applications in Systems Biology											
4	*or:* Pathogenic Plant-Fungus Interactions				*or:* Protein Biophysics							
5	(TM1-4: Examinations)				(TM1-4: Examinations)				(TM1-4: Examinations)			
6												
7	**VM1/2 (12 CP):** Microbiology 2				**VM1/2 (12 CP):** Plant Physiology 2				**VM3 (12 CP):** PracticeModule / Industrial Traineeship	**FM (15 CP):** Research Practical		
8	*or* : Molecular Biotechnology 1				*or* : Plant Pathology 2							
9	*or* : Molecular Biotechnology 2				*or* : Protein Biophysics							
10	*or:* Molecular Biophysics											
11	*or* : Molecular Genetics											
12												
13												
14												
15ff.												

*During the semester

**Not required if done in Semester 1

TM1-4: Drug Discovery & Development*

Curriculum of the Master Program 'Biology' with Specialization 'MCB'

Week	1. Semester (WS, 30 CP)				2. Semester (SS, 30 CP)				3. Semester (WS, 30 CP)			4. Semester (SS, 30 CP)
-1	**TM6a (2 CP):** Warmup											
1	**TM1-4 (3 CP):** Genetics, Genomics and Epigenetics*	**TM5a (3 CP):** Lecture 'Modern Methods in Biology 1'	**TM6b (1 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	**TM1-4 (3 CP):** Molecular Medicine*	**TM5b (3 CP):** Lecture 'Modern Methods in Biology 2'	**TM6b (3 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	*if applicable:* **TM1-4:** Systems Biology		**WM (3 CP):** Courses of Choice	**MA (30 CP):** Master Thesis
2									*or:* Molecular Microbiology			
3	**TM1-4 (3 CP):** Molecular Cell Biology*				**TM1-4 (3 CP):** Cellular Biochemistry*				*if applicable:* **TM1-4:** Fundamental Concepts and Applications in Systems Biology			
4												
5	(TM1-4: Examinations)				(TM1-4: Examinations)				(TM1-4: Examinations)			
6												
7	**VM1/2 (12 CP):** Cell Biology				**VM1/2 (12 CP):** Plant Physiology				**VM3 (12 CP):** Practical Module or Industrial Traineeship	**FM (15 CP):** Research Practical		
8	*or* : Molecular Genetics				*or:* Cell Biology							
9	*or:* Molecular Biotechnology				*or:* Biochemistry				*Alternatively* Molecular Biotechnology			
10	*or:* Human Biology				*or:* Molecular Genetics				*or:* Cellular Neurobiology			
11					*or:* Drosophila Genetics				*or:* Human Biology			
12									*or:* Neurochemistry			
13												
14												
15ff.												

* Mandatory

Curriculum of the Master Program 'Biology' with Specialization 'Neuro'

Week	1. Semester (WS, 30 CP)				2. Semester (SS, 30 CP)				3. Semester (WS, 30 CP)			4. Semester (SS, 30 CP)
-1	**TM6a (2 CP):** Warmup											
1 2	**TM1-4 (3 CP):** Neural Function	**TM5a (3 CP):** Lecture 'Modern Methods in Biology' 1	**TM6b (1 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	**TM1-4 (3 CP):** Neural Plasticity *if applicable:* Molecular Medicine	**TM5b (3 CP):** Lecture 'Modern Methods in Biology' 2	**TM6b (3 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	(if applicable) as in 1. Semester*		**WM (3 CP):** Courses of Choice	**MA (30 CP):** Master Thesis
3 4	**TM1-4 (3 CP):** Neural Development				**TM1-4 (3 CP):** Neural Networks							
5 6	(TM1-4: Examinations)				(TM1-4: Examinations)				(TM1-4: Examinations)			
7 8 9 10 11 12 13 14	**VM1/2 (12 CP):** Neurobiology of Vertebrates 2 *or:* Cellular Neurobiology 1, 2 *or* 3 *or:* Neurochemistry 1 *or* 2				**VM1/2 (12 CP):** Neurobiology of Vertebrates 3 *or:* Cellular Neurobiology 3				**VM3 (12 CP):** Practical Module / Industrial Traineeship	**FM (15 CP):** Research Practical		
15ff.												

* Not required if done in Semester 1

Curriculum of the Master Program 'Biology' with Specialization 'Eco'

Week	1. Semester (WS, 30 CP)				2. Semester (SS, 30 CP)				3. Semester (WS, 30 CP)			4. Semester (SS, 30 CP)
-1	**TM6a (2 CP):** Warmup											
1 2	**TM1-4 (3 CP):** Molecular Microbiology *or:* Ecology of Species Interactions	**TM5 (3 CP):** Lecture 'Modern Methods in Biology' 1	**TM6 (1 CP):** Research Project Presentations	**WM (6 CP)** Courses of Choice	**TM1-4 (3 CP):** Aquatic Microbial Ecology *or:* Applied Microbial Genetic	**TM5 (3 CP):** Lecture 'Modern Methods in Biology' 2	**TM6 (3 CP):** Research Project Presentations	**WM (6 CP):** Courses of Choice	(if applicable) as in 1. Semester**		**WM (3 CP):** Courses of Choice	**MA (30 CP):** Master Thesis
3 4	**TM1-4 (3 CP):** Molecular Ecology* *or:* Pathogenic Plant-Fungus Interactions				**TM1-4 (3 CP):** Plant Acclimation							
5 6	(TM1-4: Examinations)				(TM1-4: Examinations)				(TM1-4: Examinations)			
7 8 9 10 11 12 13 14	**VM1/2 (12 CP):** Molecular Ecology* *or:* Microbiology 2				**VM1-3 (12 CP):** Plant Ecology *or:* Plant Pathology 2				**VM3 (12 CP):** Practical Module or Industrial Traineeship	**FM (15 CP):** Research Practical		
15ff.												

* Mandatory

** Not required if done in Semester 1

Compendium of Modules in the Master Program 'Biology'

With the Four Majors

Microbial and Plant Biotechnology (MPBiotec)

Molecular Cell Biology (MCB)

Neurobiology (Neuro)

Ecology (Eco)

at the Faculty of Biology of the University of Kaiserslautern (TUK)
(last update: 03.07.2019)

In general:
For general information, please contact the coordinators of the four major fields of study.
For module-specific questions, please contact the module coordinators.

Coordinators of major fields of study:

MPBiotec: Prof. Dr. Matthias Hahn (0631-2052402, hahn@biologie.uni-kl.de)

MCB: Prof. Dr. Johannes Herrmann (0631-2052406, hannes.herrmann@biologie.uni-kl.de)

Neuro: Prof. Dr. Jan Pielage (0631-2052426, pielage@biologie.uni-kl.de)

Eco: Prof. Dr. Thorsten Stoeck (0631-2052502, thorsten.stoeck@biologie.uni-kl.de)

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Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study

Last update: July 2019

Title	Department	Sem.	Major			
			MPBiotec	MCB	Neuro	Eco
Plant Biotechnology	Pflanzenphysiologie	SS	+	+		
Mass Spectrometry and Deep Sequencing based Strategies in Systems Biology	Molekulare Biotechnologie und Systembiologie &	WS	+	+		
Fundamental Concepts and Applications in Systems Biology	Computergestützte Systembiologie	WS	+	+		
Molecular Microbiology	Mikrobiologie	WS	+	+		+
Pathogenic Plant-Fungus Interactions	Phytopathologie	WS	+			+
Protein Biophysics	Molekulare Biophysik	SS	+			
Plant Acclimation (SFB)	Several departments	SS	+			+
Drug Discovery & Development	Molekulare Biotechnologie und Systembiologie	SS*	+			
Molecular Cell Biology	Zellbiologie	WS		+		
Genetics, Genomics and Epigenetics	Molekulare Genetik	WS	+	+		
Cellular Biochemistry	Zellbiologie	SS		+		
Molecular Medicine	Humanbiologie und Humangenetik, Zellbiologie	SS		+	(+)	
Neural Function	Humanbiologie und Humangenetik	WS			+	
Neural Development	Zoologie	WS			+	
Neural Plasticity	Tierphysiologie	SS			+	
Neural Networks	Zoologie, Tierphysiologie	SS			+	
Molecular Ecology	Molekulare Ökologie	WS				+
Aquatic Microbial Ecology	Ökologie	SS				+
Ecology of Species Interactions	Pflanzenökologie und Systematik	WS				+

*all TM1-4 are offered as block courses with the exception that 'Drug Discovery & Development' is taught during the semester. (+) TM1-4 potentially selectable after consultation with module coordinator.

<table>
<tr><td colspan="7">Theoretical Module 1-4: Lecture and Reading Course - Plant Biotechnology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. E. Neuhaus</td><td colspan="3">Prof. E. Neuhaus, Dr. I. Haferkamp, Dr. O. Trentmann</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td colspan="2">Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90</td><td>3</td><td>2nd semester</td><td colspan="2">1 semester</td><td>Anually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="3">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course</td><td colspan="2">Plant Biotechnology</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="6">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="6">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: Creation and verification of transgenic plants. Plant primary metabolism and its relation to quality traits, like e.g. photosynthesis and levels of starch and sugars. Plant lipids, metabolism and high value oils from plants. Protein synthesis in plants; mechanisms and modes of optimization. Optimized fruit and seed properties. Plants as sources for recombinant proteins with pharmacological relevance. Metal homeostasis and site-directed modification of plants to altered metal availability. Physiology of salt and optimized salt tolerance of higher plants. Higher plants as sources for biofuels and biomaterials. Secondary plant products with relevance for human diet.</td></tr>
<tr><td>4.</td><td colspan="6">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of plant primary metabolism and its relation to quality traits, and options to use this knowledge for increasing and improving plant performance with regard to these traits.
– Understanding adaptation mechanisms of plants to abiotic stresses.
– Knowing strategies for the use and improvement of plants as sources for biofuels and high-value biomaterials.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of molecular plant biotechnology. read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prere-quisites:	Bachelor-grade knowledge in molecular biology, genetics, botany, plant physiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Will be provided during the orientation meeting of the course
	Available documents:	Will be provided during the orientation meeting of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Mass Spectrometry and Deep Sequencing based Strategies in Systems Biology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. M. Schroda; Jun.-Prof. T. Mühlhaus</td><td colspan="2">Prof. M. Schroda; Jun.-Prof. T. Mühlhaus; Dr. F. Sommer</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course</td><td>Mass Spectrometry and Deep Sequencing based Strategies in Systems Biology</td><td>24 h</td><td>66 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective course</td></tr>
<tr><td>3.</td><td colspan="5">Content:
The students will hear introductory lectures, read research and review papers, and discuss together and with the teacher the following topics:
– Hardware and device
– Deep sequencing techniques
– Quantitative proteomics strategies
– Experimental design using deep sequencing technology and quantitative proteomics</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of current next generation sequencing (NGS) methods.
– Knowledge on how mass analyzers work and how they are implemented in modern mass spectrometers
– Understanding how peptide sequences can be identified from fragment spectra and how protein abundance can be estimated from mass spectra
– Gaining fundamental knowlege of the different approaches and experimental basics to use deep sequencing and MS-based methods
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts</td></tr>
</table>

	– Learning to simplify complicated topics and ideas and to identify their key aspects ☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature and identification of aspects that require further explanation – Critical evaluation of current research data Intended Learning Outcomes: On successfully completing the module students will be able to… – understand the molecular and technological basis of NGS and MS-based methods. – read and understand English literature on Systems Biology approaches. – read and discuss research papers orally.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in Molecular Biotechnology, Genetics, Biochemistry, and Cell Biology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Bioanalytik, F. Lottspeich, J.W. Engels 2012, Springer Spektrum; original/review articles will be provided at or prior to the beginning of the course
	Available documents:	PDFs of lecture and literature for seminar will be provided on the homepage of the department Molecular Biotechnology & Systems Biology
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Fundamental Concepts and Applications in Systems Biology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Jun.-Prof. T. Mühlhaus; Prof. M. Schroda</td><td colspan="2">Jun.-Prof. T. Mühlhaus; Prof. M. Schroda; Dr. F. Sommer</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course</td><td>Fundamental Concepts and Applications in Systems Biology</td><td>24 h</td><td>66 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
The students will hear introductory lectures, read research and review papers, and discuss together and with the teacher the following topics:
– Quantitative biology and Systems Biology
– Basic concepts in bioinformatics including biostatistics, machine learning and network analysis
– Application of quantitative methods in Plant Systems Biology research</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Knowledge on statistical testing and maschine learning used in quantitative biology
– Understanding the concept of connectivity in biological systems and methods for it's analysis
– Understanding the principles and pitfalls of quantitative methods applied to biological question
– Application of deep sequencing technologies and quantitative proteomics strategies to answer a specific questions in Plant Systems Biology research
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts
– Learning to simplify complicated topics and ideas and to identify their key aspects</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature and identification of aspects that require further explanation – Critical evaluation of current research data Intended Learning Outcomes: On successfully completing the module students will be able to… – understand the foundation of Systems biology with a special focus on the application of quatitative and computational methods in biology – read and understand English literature on Systems Biology approaches – read and discuss research papers orally	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in Molecular Biotechnology, Genetics, Biochemistry, and Cell Biology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Will be provided at or prior to the beginning of the course
	Available documents:	PDFs of lecture and literature for seminar will be provided on the homepage of the department Molecular Biotechnology & Systems Biology
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Molecular Microbiology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. N. Frankenberg-Dinkel</td><td colspan="2">Prof. N. Frankenberg-Dinkel, Dr. S. Zehner</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Molecular Microbiology</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read text book chapters, research and review papers, and discuss together and with the teacher the following topics: Microbial biofilms, mechanisms of transcriptional regulation in Bacteria and Archaea, mechanisms of posttranscriptional regulation, advanced microbial physiology</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of regulation in prokaryotes, regulation of biofilm lifestyle and microbial physiology.
– Critical reading, interpreting and discussing current research papers and reviews on these topics, and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.
Intended Learning Outcomes:
On successfully completing the module students will be able to…
– improve their knowledge in the field of molecular microbiology.</td></tr>
</table>

	– read and understand specialist English literature (text book chapters, research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in microbiology, genetics, biochemistry, (plant physiology)
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Joan L. Slonczewski (Autor), John W. Foster (Autor): Microbiology: An Evolving Science, 3rd International Student Edition; W.W. Norton & Company
	Available documents:	Will be provided at or prior to the beginning of the course via OLAT or Microbiology homepage
10.	Registration procedure: Sign-up in KIS required	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Pathogenic Plant-Fungus Interactions</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. M. Hahn</td><td colspan="2">Prof. M. Hahn</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture:</td><td>Pathogenic Plant-Fungus Interactions</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: Cytology and molecular biology of fungal invasion into host plants. Fungal virulence mechanisms. Molecular pathogen-host communication via the apoplast and the host cytoplasm. Fungal effectors and (host-specific) toxins as virulence and avirulence factors. Recognition-based host resistance: MAMP- and effector-triggered immunity responses. Modern approaches for generating (transgenic) resistant crop plants.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of fungal virulence and plant defence mechanisms and their coevolution in natural and agricultural environments.
– Gaining the ability to extending these concepts to other pathogenic plant-microbe interactions.
– Reading and interpreting current research papers and reviews about this topic, and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – demonstrate deepened knowledge in specific fields of molecular plant pathology, in particular pathogenic fungus-plant interactions. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.
5.	Prerequisites for attending:
	Formal admission requirements: — Admission to the Master Program 'Biology'
	Contentual prere-quisites: — Bachelor-grade knowledge in molecular biology, genetics, botany, plant physiology, and plant pathology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance
7.	Determination of grade:
	Grade: — Result of the written examination
	Significance for final grade: — 3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above
9.	Hints for preparation:
	Recommended literature: — Lo Presti et al. (2015) Fungal effectors and Plant Susceptibility. Annu Rev Plant Biol Plant Biol 66: 513-45. Jones and Dangl (2006) The plant immune system. Nature 444: 323-329. Dangl et al.. (2013) Pivoting the Plant Immune System from Dissection to Deployment. Science 341: 746-751. (available at https://www.bio.uni-kl.de/phytopathologie/lehre-teaching/)
	Available documents: — Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---
11.	Language: English

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Protein Biophysics</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. S. Keller</td><td colspan="2">Prof. S. Keller</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td>annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Protein Biophysics</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read book chapters as well as research and review papers, work on specific problems (exercises), and discuss together and with the teacher the following topics: Protein structure, dynamics, and function. Evolutionary variations in proteins. Molecular recognition and specificity. Protein–protein and protein–ligand interactions. Allostery. Enzyme catalysis. Membrane proteins and transport processes. Recombinant production and chromatographic purification of proteins. Biophysical and biochemical methods for protein characterization.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Explaining the properties and functions of proteins on the basis of their structures and dynamics.
– Understanding the molecular basis underlying intermolecular interactions (including target binding and inhibition), enzyme catalysis, and protein-mediated membrane transport.
– Gaining the ability to extend these concepts to biotechnological and biomedical applications of proteins.
– Reading and interpreting current research papers and reviews about this topic. Understanding in vitro approaches to proteins.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Solving problems and critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of protein biophysics. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prere-quisites:	Bachelor-grade knowledge in molecular biology, genetics, botany, plant physiology, plant pathology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance and solving excerises	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Will be provided at or prior to the beginning of the course
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="7">Theoretical Module 1-4: Lecture and Reading Course - Plant Acclimation</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Jun.-Prof. F. Willmund</td><td colspan="3">Dr. T. Möhlmann, Jun.-Prof. T. Mühlhaus, Prof. E. Neuhaus, Prof. M. Schroda, Dr. F. Sommer, Jun.-Prof. F. Willmund, Dr. D. Scheuring</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td colspan="2">annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td colspan="2">Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course:</td><td>Plant acclimation</td><td>18 h</td><td>72 h</td><td colspan="2">3 CP</td></tr>
<tr><td>2.</td><td colspan="6">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="6">Content:
– The class will be a combination of lecture and reading course. In the morning, two hours of lecture introduce the different aspects of plant acclimation. Here, we will study different aspects how plant cells acclimate to changing environmental conditions (such as changes in light intensity/quality and temperature). After each lecture, literature will be provided for the intensive study of the specific aspects. The studies will be summarized in a closing discussion at the end of each day. The last two days are dedicated for literature studies addressing plant acclimation by Systems Biology approaches.

– Schedule and content:
Day 1: Introduction into the topic: the challenge of global warming and the concept of the Transregio SFB research consortium “Green Hub” at the TU KL (Jun. Prof. F. Willmund)
Day 2: Concepts of homeostasis (Jun.-Prof. T. Mühlhaus)
Day 3: Carbohydrate homeostasis (Prof. E. Neuhaus)
Day 4: Energy balances during acclimation (Dr. T. Möhlmann)
Day 5: Protein homeostasis (Prof. M. Schroda)
Day 6: Transcriptional and translational regulation (Jun. Prof. F. Willmund)
Day 7: Cell biology (Dr. Scheuring)
Day 8: Time for preparation of the seminars
Day 9: Student presentations</td></tr>
</table>

	Day 10: Student presentations	
4.	Competencies and Intended Learning Outcomes: Competencies: ☒**Professional competence**: – Understanding the different levels of plant acclimation to abiotic changes of environmental conditions. – Background information about an interdisciplinary research consortium, reading and interpreting current research papers and reviews about this topic and discussion of how to address plant acclimation by Systems Biology approaches. ☐**Methodological competence:** --- ☒**Social competence**: – Learning to discuss scientific issues with other students and the teacher and explaining complex concepts. – Learning to simplify complicated topics and ideas and to identify their key aspects. ☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of Plant Physiology, Systems Biology and Plant Biochemistry. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, genetics, biochemistry, botany, plant physiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87

8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Will be provided at or prior to the beginning of the course
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Drug Discovery and Development</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">PD Dr. G. Erkel</td><td colspan="2">PD Dr. G. Erkel</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td>annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture:</td><td>Drug Discovery and Development</td><td>2 SWS x 14 = 28 h</td><td>62 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures about the following topics: drug discovery and development from natural sources, screening systems, ADME, toxicology, recent developments in the identification of cellular targets and signal transduction pathways involved in the regulation of disease relevant genes and their therapeutic intervention.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of signal transduction and gene regulation in eukaryotic cells, mode of action of natural inhibitors of the cell cycle, cellular signaling pathways with particular reference to inflammation, allergy and cancer.
– Exploration and evaluation of new targets and novel principles for a rational development of therapeutically advantageous new agents and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of drug discovery and development; drug targets, ADMET. – read and understand specialist English literature (research papers and reviews).	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, biochemistry, genetics
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes or oral examination covering content and educational objective with a duration of 30 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written or oral examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Original literature will be provided at or prior to the beginning of the course
	Available documents:	Original literature and lecture slides will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Molecular Cell Biology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. J. Herrmann</td><td colspan="2">Prof. J. Herrmann</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course:</td><td>Molecular Cell Biology</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will read chapters of the book “Pollard, Earnshaw: Cell Biology”, hear introductory and summary lectures, and engage in daily discussions with peers and the teacher regarding the following topics: Basic chemical and physical concepts; Membrane structure and function; Storage and expression of genetic information; Biogenesis, traffic and functions of cellular membrane systems; Reception and transduction of environmental information; Cellular interactions; Cytoskeleton and cellular motility; Cell cycle.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of the structure and function of eukaryotic cells. Understanding, interpreting and presenting complex concepts of cellular function.
– Reading a comprehensive textbook, summarizing the central ideas and discussing these with other students.
– Acquiring a general knowledge of the entire field of molecular cell biology.
☒Methodological competence:
– Understanding classical key experiments, how their results contributed in our knowledge of cell biology and explaining these experiments to others.
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – acquire a broad overview about the field of molecular cell biology. – read and understand an advanced English textbook. – summarize and discuss orally the complex concepts of different aspects of molecular biology.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, cell biology and genetics
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Pollard, Earnshaw: Cell Biology
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Genetics, Genomics and Epigenetics</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. Z. Storchová</td><td colspan="2">Prof. Z. Storchová, Jun.-Prof. F. Willmund, Dr. M. Räschle</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study:
(preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Lecture and reading course:</td><td>Genetics, Genomics & Epigenetics</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum: Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory lectures on Genetics, Genomics&Epigenetics read selected chapters of the books “21st Century Genetics” and “Epigenetics” and engage in daily summary lectures with extensive discussions on the selected topics with peers and the teacher.
– Following topics will be included: Chemical and physical basis of molecular genetics; Nucleic acid structure and function and its modifications by genetic engineering; Gene expression and its regulation; Epigenetics; Cell cycle and maintenance of genome integrity; Genomics; Human genetics and genomics; Cancer as a genome disease;</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding the molecular basis of the genetic and epigenetic determinants of cellular functions.
– Understanding, interpreting and presenting complex concepts of inheritance and the interplay between genetics and environment.
– Acquiring a general knowledge of the fast moving field of molecular genetics and genomics.
– Reading a comprehensive textbook, summarizing the central ideas and discussing these with other students.
☒Methodological competence:
– Understanding classical key experiments and the basis of their design and how their results contributed in our knowledge of molecular genetics; novel concepts of genomics and epigenetics.
– Ability to explain the key experiments and conceptes to others.</td></tr>
</table>

	☒**Social competence**: – Learning to discuss scientific issues with other students and the teacher and explaining complex concepts. – Learning to simplify complicated topics and ideas and to identify their key aspects. ☒**Self-competence**: – Acquiring scientific knowledge through first supervised and subsequently self-directed reading of English research literature and identifying points that require further explanation. Discussing with peers and the teacher. – Independent critical evaluation of current research data, identification of experimental strength and weaknesses. Intended Learning Outcomes: On successfully completing the module students will be able to… – acquire a broad overview about the field of current molecular genetics and genomics. – read and understand an advanced English textbook. – summarize and discuss the complex concepts of molecular genetics.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology and genetics, organic chemistry and biochemistry, cell biology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Grodzicker, Stewart, Stillman: 21st Century Genetics Allis, Caparros, Jenuwein, Reinberg: Epigenetics
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Cellular Biochemistry</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. J. Herrmann</td><td colspan="2">Prof. J. Herrmann, Dr. M. Räschle</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td>annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Cellular Biochemistry</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: Fundamentals of immunology. Aquired and innate immunity. Antibodies. Cells of the immune system. The complement system. Receptors of the immune system. Infection. Pathogens. Viruses, Bacteria and Pathogens. Allergy. The second week will focus on proteins. Topics include protein synthesis, modification, degradation and regulation and their role in biosignaling processes.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Gaining a broad overview of cutting edge research in regulation of cellular metabolites and their impact upon cellular physiology and function.
– To understand how metabolism may be affected by and or affect cell/organism function in disease contexts.
– Reading and interpreting current research papers and reviews about this topic, and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of cellular biochemistry/immunology. – read and understand an advanced English textbook. – summarize and discuss the complex concepts of molecular genetics.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in cell biology, cellular biochemistry, molecular genetics
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Lehninger: Principles of Biochemistry
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course – Molecular Medicine</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. S. Kins, Prof. J. Herrmann</td><td colspan="2">Prof. S. Kins, Prof. J. Herrmann</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td colspan="2">annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Molecular Medicine</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: The human genome; Biology of cancer, viral and bacterial infections, inflammation; Molecular basis of Neurodegenerative diseases: Alzheimer's Disease, Parkinson Disease, Morbus Huntington, TSE, ALS, FTLD, …</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Overview of synaptic transmission, which is central for understanding of brain function and behavior.
– Understanding the molecular basis of human diseases and to evaluate them critically. Gaining the ability to extending these concepts to other related diseases.
– Learn to develop novel pharmacological strategies. Reading and interpreting current research papers and reviews about this topic, and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of molecular mechanisms of neuronal function and human neurodegenerative diseases. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, genetics, animal physiology, neurobiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Robert A Weinberg: The Biology of Cancer; Alberts: Molecular Biology of the Cell; E. Kandel: Principles of Neuroscience, 5th edition, Part II and III; Original literature will be provided at or prior to the beginning of the course
	Available documents:	Original literature will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Neural Function</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theo-riemodul 1-4)</td><td colspan="2">Prof. S. Kins</td><td colspan="2">Prof. S. Kins</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Neural Function</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: Neural Function: Neuronal morphology, intraneuronal sorting, Neurotransmitter release, Modulation of synaptic transmission; Molecular basis of Neurodegenerative Diseases, such as Alzheimer's Disease, Parkinson Disease, Morbus Huntington, …</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Overview of neuronal structure and synaptic transmission, which is central for understanding of brain function and behavior.
– Understanding the molecular basis of human diseases and to evaluate them critically.
– Gaining the ability to extending these concepts to other related diseases.
– Learn to develop novel pharmacological strategies.
– Reading and interpreting current research papers and reviews about this topic, and understanding methodological approaches used.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.</td></tr>
</table>

	– Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of molecular mechanisms of neuronal function and human neurodegenerative diseases. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, genetics, animal physiology, neurobiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	E. Kandel: Principles of Neuroscience, 5th edition, Part II and III; L. Luo: Principles of Neurobiology; Original literature will be provided at or prior to the beginning of the course
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Neural Development</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theo-riemodul 1-4)</td><td colspan="2">Prof. J. Pielage</td><td colspan="2">Prof. J. Pielage</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td colspan="2">annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Neural Development</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss within the group and with the teacher current topics of neuronal development.
– Topics include e.g. nervous system formation, wiring of the nervous system, formation of neuronal circuits, animal behavior, modern methods in neurobiology.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Overview of the principles underlying neuronal development.
– Students will evaluate, discuss and compare a variety of experimental strategies, model systems and experimental methods used to advance our understanding of molecular and cellular aspects of neuronal development.
– Topics will be explored both in breath and in depth using a combination of text books, reviews and original research papers.
– Students will learn to critically evaluate scientific literature.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of neural development. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prere-quisites:	Bachelor-grade knowledge in molecular biology, genetics, animal physi-ology, neurobiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	E. Kandel: Principlesof Neuroscience, 5th edition; L. Luo: Principles of Neurobiology; Bear: Neuroscience; Original literature will be provided at or prior to the beginning of the course;
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Neural Plasticity</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. E. Friauf</td><td colspan="2">Prof. E. Friauf</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td colspan="2">annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Neural Plasticity</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– Students will hear introductory lectures, read selected textbook chapters at an advanced level (e.g. Bear/Connors Paradiso: Neuroscience, Exploring the Brain; chapter “Molecular Mechanisms of Learning and Memory”) and reviews as well as original research papers focussing on mechanisms of neural plasticity. Each day, the literature will be discussed amongst the group and with the lecturer.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Overview of the principles underlying several forms neuronal plasticity (habituation, sensitization, classical conditioning, long-term depression, long-term potentiation).
– Students will evaluate, discuss and compare a variety of experimental strategies, model systems and experimental methods used to advance our understanding of the molecular, cellular and microcircuital aspects of neuronal plasticity.
– Topics will be explored both in breath and in depth using a combination of text books, reviews and original research papers.
– Students will learn to critically evaluate scientific literature.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquiring scientific expertise by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of neural plasticity. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in molecular biology, genetics, animal physiology, neurobiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	1. Bear/Connors/Paradiso: Neuroscience: Exploring the Brain 2. Kandel/Schwartz/Jessell/Siegelbaum/Hudspeth: Principles of Neural Science 3. Kettenmann/Ransom: Neuroglia
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course - Neural Networks</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. J. Pielage, Prof. E. Friauf</td><td colspan="2">Prof. J. Pielage, Prof. E. Friauf, , Jun.-Prof. J. Hirtz</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td colspan="2">annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Neural Networks</td><td>20 h</td><td>70 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– Students will hear introductory and summary lectures, read research and review papers, and discuss within the group and with the teacher current topics of neural networks.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Overview of the principles underlying the development and function of neuronal networks.
– Students will evaluate, discuss and compare a variety of experimental strategies, model systems and experimental methods used to advance our understanding of neuronal networks.
– Topics will be explored both in breath and in depth using a combination of text books, reviews and original research papers.
– Students will learn to critically evaluate scientific literature.
☐Methodological competence: ---
☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.
☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of neural networks. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prere-quisites:	Bachelor-grade knowledge in molecular biology, genetics, animal physi-ology, neurobiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	E. Kandel: Principles of Neuroscience, 5th edition; L. Luo: Principles of Neurobiology; Paradiso, Bear, Connors: Neuroscience: Exploring the Brain and will be provided at or prior to the beginning of the course
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course – Molecular Ecology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Jun.-Prof. S. Filker</td><td colspan="2">Jun.-Prof. S. Filker</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td>annually (WS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Molecular Ecology</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum: Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: Application of molecular tool in ecology and biodiversity research, including (but not restricted to) strategies to obtain molecular data, (computational) analytical tools for molecular data in ecology, genetic analyses of single and multiple populations, genomics, phylogeography, behavioural ecology and conservation genetics, population genetics, use of molecular markers in ecology, molecular and adaptive radiation, molecular identification of species, individuals and sex, and molecular ecology of aquatic microbes.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Students will acquire a principle understanding of ecological concepts and the application of state-of-the-art molecular tools to study these concepts.
– With this knowledge, students will learn how to design own experiments and decide for the adequate tools to address specific questions in biodiversity research and ecology.
– The subjects of the course will be taught preliminary on aquatic ecosystem and microbial organisms.
– Through the incorporation of both theoretical and applied systems, students will learn how to use case studies to place the theory in context.
– Students will learn to transfer the acquired knowledge to other ecosystem and organisms.
– Students will learn a critical reading of literature related to the subject of this course.
☒Methodological competence:</td></tr>
</table>

	– Theoretical background on state-of-the-art methods used in modern molecular ecology, knowledge of the molecular toolbox used in ecology and biodiversity research. ☒**Social competence**: – Learning to discuss scientific issues with other students and the teacher and explaining complex concepts. – Learning to simplify complicated topics and ideas and to identify their key aspects. ☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of molecular ecology. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in ecology, zoology, botany, microbiology, physics and chemistry
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Will be provided at or prior to the beginning of the course
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course – Aquatic Microbial Ecology</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Prof. T. Stoeck</td><td colspan="2">Prof. T. Stoeck, Dr. S. Filker</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">90 h</td><td>3 CP</td><td>2nd semester</td><td>1 semester</td><td>annually (SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td>a) Seminar:</td><td>Molecular Ecology</td><td>16 h</td><td>74 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum: Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students will hear introductory and summary lectures, read research and review papers, and discuss together and with the teacher the following topics: General comparison of terrestrial and aquatic environments as a habitat – some ecological principles; properties of water; division of the aquatic environments; eukaryotic phytoplankton (composition, floating mechanisms, primary production and factors affecting primary production, community dynamics of phytoplankton); heterotrophic protists (composition, ecology); roles of microbes in aquatic food webs; bacteria, archaea and viruses, extremophiles (such as hypersaline lakes, hydrothermal vents, deep-sea, glacier lakes, ice)</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Students will acquire a principle understanding of concepts in aquatic microbial ecology. Comparisons to principles of terrestrial ecology will enable students to recognize the forces shaping aquatic ecology.
– Building on this knowledge, students will learn to identify gaps in current research in aquatic microbial ecology.
– With the background taught in this course, students will be able to understand the motivation of current research papers in this field of ecology and also to recognize the advance of knowledge added by current research papers.
– In combination with the theory module “Molecular Ecology”, students will be able to design projects to fill the gaps of knowledge in this field of research.
– Students will learn a critical reading of literature related to the subject of this course.
☒Methodological competence:</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">
– Background (theory) on methods, which were used to acquire our current knowledge in aquatic microbial ecology.

☒Social competence:
– Learning to discuss scientific issues with other students and the teacher and explaining complex concepts.
– Learning to simplify complicated topics and ideas and to identify their key aspects.

☒Self-competence:
– Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation.
– Critical evaluation of current research data.

Intended Learning Outcomes:
On successfully completing the module students will be able to…
– improve their knowledge in the field of molecular ecology.
– read and understand specialist English literature (research papers and reviews).
– summarize and discuss orally research papers.
</td></tr>
<tr><td rowspan="3">5.</td><td colspan="2">Prerequisites for attending:</td></tr>
<tr><td>Formal admission requirements:</td><td>Admission to the Master Program ‘Biology’</td></tr>
<tr><td>Contentual prerequisites:</td><td>Bachelor-grade knowledge in molecular biology, ecology, genetics, computational biology, zoology, botany, microbiology</td></tr>
<tr><td>6.</td><td colspan="2">Requirements for receiving credit points:
i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance</td></tr>
<tr><td rowspan="3">7.</td><td colspan="2">Determination of grade:</td></tr>
<tr><td>Grade:</td><td>Result of the written examination</td></tr>
<tr><td>Significance for final grade:</td><td>3/87</td></tr>
<tr><td>8.</td><td colspan="2">Applicability of the module/suitability:
Please see ‘Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study’ above</td></tr>
<tr><td rowspan="3">9.</td><td colspan="2">Hints for preparation:</td></tr>
<tr><td>Recommended literature:</td><td>Will be provided at or prior to the beginning of the course</td></tr>
<tr><td>Available documents:</td><td>Will be provided at or prior to the beginning of the course</td></tr>
<tr><td>10.</td><td colspan="2">Registration procedure: ---</td></tr>
<tr><td>11.</td><td colspan="2">Language: English</td></tr>
</table>

<table>
<tr><td colspan="6">Theoretical Module 1-4: Lecture and Reading Course – Ecology of Species Interactions</td></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 1-4 (Theoriemodul 1-4)</td><td colspan="2">Dr. R. Wirth</td><td colspan="2">Dr. R. Wirth</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>90 h</td><td>3 CP</td><td>1st or 3rd semester</td><td>1 semester</td><td colspan="2">annually (WS)</td></tr>
<tr><td>1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td></td><td>a) Tutorial:</td><td>Ecology of Species Interactions</td><td>6 h</td><td>24 h</td><td>1 CP</td></tr>
<tr><td></td><td>b) Seminar:</td><td>Ecology of Species Interactions</td><td>10 h</td><td>50 h</td><td>2 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum: Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– How do species interactions shape ecological patterns & processes?
– How to read a scientific paper and grasp its concepts?
– We will hear introductory and ad-hoc lectures, read scientific papers, and discuss them: The seminar/tutorial addresses multiple forms of antagonistic, collaborative, and higher–order species interactions by thorough reading and presentation of selected articles, both classical and contemporary ones. Key topics include (i) herbivory and plant defense, (ii) chemical ecology and behavioral ecology of foraging, (iii) food web ecology, (iv) facultative and obligate mutualisms, (v) facilitation, (vi) ecosystem engineering, (vii) human impacts on plant animal interactions, (viii) biodiversity and community biology. The objective of the course is not only to familiarize with and extract the theoretical ecological concepts but also to understand the design and analytic tools necessary for conducting a scientific research project.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Understanding pertinent scientific concepts in ecology.
– Identify the key ideas as well as the theoretical and experimental approach of ecological studies.
– Familiarize with seminal papers and widely cited publications in the field.
– Reading and scientific writing skills.</td></tr>
</table>

	– Interpreting research findings and their implications. ☒**Methodological competence:** – Critical reading of scientific texts, preparation and putting together presentations, discussion and communication skills, ability to simplify complicated topics and ideas and to identify their key aspects. ☒**Social competence**: – Improvement of teamwork skills; learning to present published knowledge and own ideas to an audience. – Develop the ability to discuss scientific issues with other students and the teacher and explaining complex concepts. ☒**Self-competence**: – Acquirement of scientific knowledge by self-responsible reading of English research literature, and identifying points that require further explanation. – Critical evaluation of current research data. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in the field of ecology, behavioral biology, evolutionary biology. – read and understand specialist English literature (research papers and reviews). – summarize and discuss orally research papers.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in zoology, botany, statistics, plant physiology
6.	Requirements for receiving credit points: i) Passed examination (written examination covering content and educational objective with a duration of 90 minutes), ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the written examination
	Significance for final grade:	3/87
8.	Applicability of the module/suitability: Please see 'Synoptical Table of Theoretical Modules 1-4: Choices and their Assignment to the Major Fields of Study' above	
9.	Hints for preparation:	
	Recommended literature:	Herrera CM, Pellmyr O (2002) Plant–animal interactions. An evolutionary approach. Wiley-Blackwell, Oxford, UK;

		Gurevitch J, Scheiner SM, Fox GA (2006) The Ecology of Plants. 2nd edition. Sinauer Associates, Inc., Sunderland; Howe & Westley: Ecological Relationships of Plants and Animals - Oxford University Press (see also German edition: Anpassung und Ausbeutung – Spektrum)
	Available documents:	Will be provided at or prior to the beginning of the course
10.	Registration procedure: ---	
11.	Language: English	

<table>
<tr><th colspan="7">Theoretical Module 5: Lecture - Modern Methods in Biology</th></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 5 (Theorie-modul 5)</td><td colspan="2">Jun.-Prof. F. Willmund, Jun.-Prof. S. Filker, Prof. M. Hahn</td><td colspan="3">Teachers of the Master Program ‘Biology’</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td colspan="2">Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">180 h</td><td>6 CP</td><td>1st and 2nd semester</td><td colspan="2">2 semesters</td><td>annually</td></tr>
<tr><td>1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td></td><td>a) Lecture:</td><td>Modern Methods in Biology (TM5a)</td><td>2 SWS x 14 = 28 h</td><td>62 h</td><td>3 CP</td></tr>
<tr><td></td><td>b) Lecture:</td><td>Modern Methods in Biology (TM5b)</td><td>2 SWS x 14 = 28 h</td><td>62 h</td><td>3 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Compulsory module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– This team-taught lecture provides an overview of a range of up-to-date methods that are currently used in the groups that are involved in the Master program.
– Each of the methods are presented by expert teachers (research assistants, junior professors and professors) who have worked with them in their groups. After introduction into the theoretical background and the principle of the methods, the teachers describe their implementation, enabling the students to use them in their future practicals and research work.
– The lecture also increases the capability of the students to connect research topics with the appropriate methodological approaches, and deepen their problem-solving scientific abilities.

<u>Current Topics:</u>
– Smart PCR applications, new sequencing technologies
– Synthetic (micro)biology
– Gene expression and promoter analysis
– Deciphering bacterial gene function and gene regulation
– Knock-out, knock-down mutagenesis in mice and animals
– Proteomics workflow
– Analysis of protein function
– Heterologous protein expression systems: E. coli, yeast and Xenopus oocytes
– Enzyme and metabolite analyses
– Immunochemical methods
– Protein-protein interactions
– Biophysical methods for protein analysis
– Scanning electron microscopy</td></tr>
</table>

<table>
<tr><td></td><td>– Fluorescent in situ hybridization</td></tr>
<tr><td>4.</td><td>Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Learning the principles of modern methods used in biological sciences, and their possible applications.
☒Methodological competence:
– Ability to define criteria for choosing an appropriate method for the scientific problem to be solved
☐Social competence: ---
☐Self-competence: ---
Intended Learning Outcomes:
On successfully completing the module students will be able to…
- understand and to explain the principles of modern methods in biology.
- identify methods are appropriate to solve experimental problems.</td></tr>
<tr><td>5.</td><td>Prerequisites for attending:<table><tr><td>Formal admission requirements:</td><td>Admission to the Master Program ‘Biology’</td></tr><tr><td>Contentual prerequisites:</td><td>Bachelor-grade knowledge in biology</td></tr></table></td></tr>
<tr><td>6.</td><td>Requirements for receiving credit points:
i) Passed examinations (partial tests: two written examinations covering content and educational objective of the respective semester with a duration of 90minutes each), ii) additional non-graded course achievements: regular and active attendance.</td></tr>
<tr><td>7.</td><td>Determination of grade:<table><tr><td>Grade:</td><td>Overall average of grades of the two written examinations</td></tr><tr><td>Significance for final grade:</td><td>6/87</td></tr></table></td></tr>
<tr><td>8.</td><td>Applicability of the module/suitability:
---</td></tr>
<tr><td>9.</td><td>Hints for preparation:<table><tr><td>Recommended literature:</td><td>Provided by the teachers on their websites</td></tr><tr><td>Available documents:</td><td>Provided by the teachers on their websites</td></tr></table></td></tr>
<tr><td>10.</td><td>Registration procedure: ---</td></tr>
<tr><td>11.</td><td>Language: English</td></tr>
</table>

<table>
<tr><th colspan="6">Theoretical Module 6: Warmup Meeting & Research Project Presentations</th></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="2">Teaching Staff:</td></tr>
<tr><td colspan="2">TM 6 (Theoriemodul 6)</td><td colspan="2">Prof. M. Hahn (VR MPBiotec), Prof. J. Herrmann (VR MCB), Prof. S. Kins (VR Neuro), Prof. T. Stoeck (VR Eco)</td><td colspan="2">Teachers of the Master Program ‘Biology’</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">180 h</td><td>6 CP</td><td>1st and 2nd semester</td><td>2 semesters</td><td>annually</td></tr>
<tr><td>1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td></td><td>a) Seminar:</td><td>Warmup meeting
(Students of the Master program)</td><td>12 h</td><td>48 h</td><td>2 CP</td></tr>
<tr><td></td><td>b) Lecture:</td><td>Research project presentations
(1. Students of the Master program; 2. PhD students; 3. Invited scientists)</td><td>60 h</td><td>60 h</td><td>4 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Compulsory module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– The students become familiarized with the latest developments in the fields of modern biology, in particular with topics of one of the four directions they have chosen. In the warmup meeting, they report on their own Bachelor projects, and are introduced into the research topics covered by the groups engaged in the chosen direction of the Master program.
– By attending and participating in discussions about presentations of advanced Master students (2 dates), PhD students during their Thesis Defences (3 dates), and lectures of invited researchers during the weekly ‘Biological Colloquium’ (10 dates), they deepen their knowledge and ability to keep abreast with modern life sciences.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Learning to prepare, to present and to discuss own scientific presentations. Learning to understand high-level scientific presentations and to discuss their contents.
☐Methodological competence: ---
☐Social competence: ---</td></tr>
</table>

	☒**Self-competence**: – Acquirement of scientific knowledge by listening to research lectures, complemented by self-responsible reading of English research literature. Intended Learning Outcomes: On successfully completing the module students will be able to… – improve their knowledge in various fields of modern biology. – listen, understand, summarize and discuss orally presented research topics in English.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in biology and related fields
6.	Requirements for receiving credit points: Non-graded course achievements: regular and active attendance of the lectures and the seminar, oral presentations	
7.	Determination of grade:	
	Grade:	Non-graded
	Significance for final grade:	---
8.	Applicability of the module/suitability: ---	
9.	Hints for preparation: none	
10.	Registration procedure: Invitations to the Warmup meeting and the Master Project Presentations, and control of attendance will be organized by the module coordinators	
11.	Language: English	

Courses of Choice (incl. Soft Skills)

Code:	Module Coordinator:		Teaching Staff:	
WM (Wahlmodul: Lehrveranstaltungen nach Wahl)	Prof. M. Schroda (VR MPBiotec), Prof. J. Herrmann (VR MCB), Prof. S. Kins (VR Neuro), Prof. T. Stoeck (VR Eco)		Teachers of the Master Program 'Biology' and teachers of different faculties of the University Kaiserslautern	
Workload Total (30 hrs. = 1 CP):	Credit Points (CP):	Recommended Semester:	Duration:	Regular cycle:
In total 450 h	In total 15 CP	1st-3rd semester	2-3 Semesters	Annually (WS or SS)

1.	Parts of the module/courses:	Attendance time:	Private Study: (preparation + follow up)	Credit Points (CP):
	Free choice of practicals, lectures, seminars or other credited courses	Depending on the courses chosen	Depending on the courses chosen	Depending on the courses chosen

The module 'Courses of Choice' comprises courses that are not necessarily thematically connected to each other, and can be offered by the Faculty of Biology or other Faculties either at our or at other Universities or institutions. These include theoretical topics and methods in biology and non-biological fields of expertise, excursions as well as interdisciplinary courses, including those that convey general professional competences (soft skills) and language courses. For foreign students, German courses above A2 level, and for all students, English courses above B2 level can be credited.

Additional 'Lecture and Reading Courses' belonging to the portfolio of TM1-4 can also be credited as 'Courses of Choice' (see current assortment of TM1-4 above).

Of the 15 CP, 3-6 CP have to be achieved by courses in which soft skills are conveyed (including all seminars in which students give oral presentations); a maximum of 8 CP can be achieved by practical courses.

Following a synoptical listing of recommended courses (Last update June 2019):

Please note that the language of lecture name and content indicates the main language of teaching.

Examples of theoretical and practical classes offered by the Faculty of Biology:

- **Biological Colloquium**
  - KIS identifier: BIO-BIO-01-W-4
  - Teaching staff: Teachers of the Master Program 'Biology'
  - Department: all departments of the Biology faculty
  - Content: Research project presentations from external speakers regarding specific biological topics;

- Remarks: http://www.bio.uni-kl.de/aktuelles/bio-kolloquium/; at maximum 1 CP (≙ 10 visits)
- Credit Points: 1 CP

– **Recent Topics in Neurobiology**
  - KIS identifier: BIO-ZOO-09-S-9
  - Teaching staff: Prof. E. Friauf, Prof. S. Kins, Prof. J. Pielage, Jun.-Prof. J. Hirtz
  - Department: Tierphysiologie, Humanbiologie und Humangenetik, Zoologie, Physiologie Neuronaler Netzwerke
  - Content: Current research topics in the field of neurobiology
  - Credit Points: 1 CP

– **Membrane Biophysics**
  - KIS identifier: BIO-MBP-03-S-3
  - Teaching staff: Prof. S. Keller
  - Department Molekulare Biophysik
  - Content: Current research topics in the field of Membrane Biophysics
  - Credit Points: 3 CP

– **Special Training 'Molecular Biotechnology'**
  - KIS identifier: BIO-BTE-05-L-5
  - Teaching staff: Prof. M. Schroda, Jun.-Prof. F. Willmund, Jun.-Prof. T. Mühlhaus, PD Dr. G. Erkel
  - Department: Molekulare Biotechnologie und Systembiologie
  - Content: Current research topics in the field of systems biology, molecular biotechnology and bioinformatics
  - Credit Points: 9 CP

– **Seminar Plant Ecology and Systematics**
  - KIS identifier: BIO-PÖS-07-S-8
  - Teaching staff: Dr. R. Wirth, Dr. L. Briegel-Williams, Natalie Kunz
  - Department: Pflanzenökologie und Systematik
  - Content: Ongoing and finalized research projects in the department. Presentation and discussion of current scientific publications reflecting a variety of themes such as: ecophysiology and phylogeny of biological soil crusts; ecology of semi-arid systems, community ecology and ecosystem properties; biodiversity, genetic diversity and ecosystem resilience under global change scenarios; impacts of ecosystem engineers on vegetation regeneration; plant-herbivore interactions; role of biological soils crusts and leaf-cutting ants on soil dynamics and successional pathways; socioecological issues in modern ecological research
  - Credit Points: tbd

– **Molecular Basis of Human Diseases**
  - KIS identifier: BIO-ZBI-01-S-4
  - Teaching staff: Prof. J. Herrmann

- Department: Zellbiologie
- Content: In this basic course, a variety of diseases will be introduced and details of the pathology and therapy of patients will be discussed. A basic knowledge of molecular cell biology is required.
- Credit Points: 3 CP

– **Statistics for (Neuro-) Biologists**
  - KIS identifier: BIO-TPH-13-S-3
  - Teaching staff: Prof. E. Friauf
  - Department: Tierphysiologie
  - Content: Basic statistical tests for comparing samples; practical training in Excel; understanding the statistics in scientific figures
  - Credit Points: 1 CP

– **Biolog*innen im Beruf – Berufsfelder und -perspektiven**
  - KIS identifier: BIO-BIO-17-S-4
  - Teaching staff: Dr. D. Hemme
  - Department: Dekanat Biologie
  - Content: eigenständige Recherche über das Angebot möglicher Berufe, Tätigkeitsbereiche und Karrierewege; Vorträge von (externen) Biolog*innen über ihren Karriereweg und ihr Berufsfeld;
  - Credit Points: 3 CP

– **Principles in Virology**
  - KIS identifier: BIO-MBI-08-V5
  - Teaching staff: Dr. Michelle Gehringer, Prof. N. Frankenberg-Dinkel
  - Department: Mikrobiologie
  - Content: Introduction into to the diverse world of viruses, viral genome structure and classification of viruses, common infection strategies, viral life cycles
  - Credit Points: 3 CP

– **Biodiversity of Native Plants** (Spezialpraktikum zur Biodiversität heimischer Flora)
  - KIS identifier: BIO-PÖS-16-L-6
  - Teaching staff: Dr. R. Wirth
  - Department: Pflanzenökologie und Systematik
  - Content: Biodiversity of native plants in the German flora. The practical provides a deepening of basic floristic knowledge and skills related to the autonomous identification of vascular plants including their taxonomic position. These competences are linked with basic information regarding natural history, ecology, and pharmacology of selected taxa. Moreover, the ecosystem context of the plant species is addressed and their assignment to european plant communities trained.
  - Credit Points: 3 CP

- **Drugs from Nature**
  - KIS identifier: BIO-BTE-01-S-7
  - Teaching staff: PD Dr. G. Erkel
  - Department: Molekulare Biotechnology und Systembioloie
  - Content: Signal transduction and gene regulation in eukaryotic cells, mode of action of natural inhibitors of the cell cycle, cellular signaling pathways with particular reference to inflammation, allergy and cancer, exploration and evaluation of new targets and novel principles for a rational development of therapeutically advantageous new agents.
  - Credit Points: 3 CP

- **Current Topics in Microbiology**
  - KIS identifier: BIO-MBI-06-S-9
  - Teaching staff: Prof. N. Frankenberg-Dinkel, apl. Prof. B. Henrich, Dr. S. Zehner
  - Department: Mikrobiologie
  - Content: Current research topics in the field of microbiology
  - Credit Points: tbd

- **Infection Mechanisms of Plant Pathogenic Microorganisms**
  - KIS identifier: BIO-PPA-04-V-4
  - Teaching staff: Prof. M. Hahn, Dr. D. Scheuring
  - Department: Phytopathologie
  - Content: Mechanisms of infection and molecular tools used by plant pathogenic microorganisms (mainly fungi, oomycetes and bacteria). Plant defence mechanisms and resistance to plant pathogens. Transgenic approaches to generate disease-resistant plants.
  - Credit Points: 3 CP

- **Molecular Biology of Plant Pathogenic Fungi**
  - KIS identifier: BIO-PPA-04-S-4
  - Teaching staff: Dr. D. Scheuring, Prof. M. Hahn
  - Department: Phytopathologie
  - Content: Presentation and discussion of current scientific publications to the field. Molecular biology and infection mechanisms of plant pathogenic fungi. Suppression of host defence, establishing either biotrophic relationships or killing and degradation of host tissue. Recognition events between pathogen and host that determine success or failure of infection.
  - Credit Points: 3 CP

- **Synthetic Biology & Systems Biology**
  - KIS identifier: BIO-BTE-06-S-6
  - Teaching staff: Prof. M. Schroda, Jun.-Prof. F. Willmund, Jun.-Prof. T. Mühlhaus, PD Dr. G. Erkel, Dr. M. Schulz-Raffelt
  - Department: Molekulare Biotechnologie und Systembiologie

- Content: Current research topics in the field of synthetic biology and systems biology
- Credit Points: 2 CP

– **Molecular Cell Biology**
  - KIS identifier: BIO-ZBI-04-S-4
  - Teaching staff: Prof. J. Herrmann
  - Department: Zellbiologie
  - Content: Literature course on reviews and original articles about molecular cell biology
  -
  - Credit Points: 3 CP

– **Physical and Biological (and Medical) Aspects of Hearing (until SS 2020)**
  - KIS identifier: BIO-TPH-04-V-4
  - Teaching staff: Prof. E. Friauf together with teachers from the Physik Faculty
  - Department: Tierphysiologie
  - Content: Physical topics: Introduction, structure of the ear (physically), classification of acoustic noise; creation, dispersion and detection of sound waves; decibel scale, auditory threshold, damage threshold, typical values of acoustic sources, mechanistic and electrical model of the ear, FE calculations, laser-Doppler vibriometry, acoustic hearing apparatus, Cochlea implant, accustic examples; Biological topics: from the outer ear to the Cochlea; Evolution of ossicle; hair cells; mechanoelectrical transduction; active Cochela amplifier (Prestin); K+ circuit; adaption of transdiuction; inner ear ontogenesis; degeneration and regeneration; deafness genes; central auditory system: brain stem, telencephalon; sound localization, space maps; olivo Cochlea system; echolocation; Speech;
  - Remarks: only every 2nd summer semester, alteration with 'Visual Perception'; biological part (Friauf part) can be attend separately
  - Credit Points: 6 CP or 3 CP (only biological part)

– **Synaptic Plasticity (until WS 2020/21)**
  - KIS identifier: BIO-TPH-10-V-4
  - Teaching staff: Prof. E. Friauf
  - Department: Tierphysiologie
  - Content: Synaptic plasticity;
  - Remarks: Accompanying lecture of AM – „Neurobiologie der Vertebraten 3"
  - Credit Points: 1 CP

– **Effective Scientific Presentation in English**
  - KIS identifier: BIO-MGE-04-S-6
  - Teaching staff: Prof. Z. Storchová Dr. Michelle Gehringer
  - Department: Molekulare Genetik, Mikrobiologie

- Content: Clear and concise presentation of research results, both in the context of oral presentations and written publications such as scientific research papers, is fundamental for effective scientific communication. This course will cover the basic techniques of scientific presentation, effective use of Power Point and other presentation soft ware, tools and rules for scientific writing, explanation of publication processes, as well as practical exercises for public presentations of students' own research.
- Credit Points: 3 CP

– **Wissenschaftliche Programmierung für Biologen**
  - KIS identifier: BIO-BTE-12-V-4
  - Teaching staff: Jun.-Prof. T. Mühlhaus
  - Department: Computergestütze Systembiologie
  - Content: Zielsetzung dieser Vorlesung mit anschließenden Übungen ist die Vermittlung von Kenntnissen über Grundlagen der funktionalen und objektorientierte Programmierung sowie die Behandlung grundlegender Datenstrukturen und Algorithmen. Vermittelt werden begriffliche Grundlagen, Konzepte, Methoden und Techniken zur Darstellung und Strukturierung von Daten und zur Entwicklung von Algorithmen. Werkzeuge des wissenschaftlichen Rechnens und der Datenverabeitung, insbesondere für die Visualisierung und Bearbeitung von Messdaten werden vorgestellt. Die Referenzsprache ist F# (FSharp), die in Kombination mit modernen Softwarebibliotheken und der Softwareumgebung R zur Problemlösung eingesetzt wird. Abschließend besteht die Möglichkeit in individuellen Projektarbeiten typische Einsatzfelder der Bioinformatik zu bearbeiten u. Problemstellungen selbstständig zu lösen.
  - Credit Points: 3 CP

– **Beschaffung von und Umgang mit Literatur**
  - KIS identifier: BIO-BIO-02-S-1
  - Teaching staff: Dr. D. Griesemer
  - Department: Fachbereichsbibliothek
  - Content: Für Bachelor- und Masterarbeiten ist es wichtig, die für das jeweilige Fachgebiet wichtigen Literaturdatenbanken zu kennen, gezielt die relevanten Publikationen zu finden, die PDFs herunterzuladen und sinnvoll zu organisieren. Im angebotenen Kurs werden neben der Vermittlung von Recherchestrategien die an der TU KL verfügbaren biologisch relevanten Datenbanken (u.A. Pubmed, Web of knowledge) näher vorgestellt. Der praktische Umgang mit diesen Datenbanken, inklusive Nutzung von Paper alert Services, wird anhand konkreter Beispiele geübt. Zusätzlich werden die Grundbausteine zum Erstellen einer wissenschaftlichen Arbeit vermittelt und dabei besonderes Augenmerk auf die Literaturverwaltung mittels spezieller Software gelegt. Lernziel: Die Teilnehmer/innen verfügen über Kenntnisse zu Auswahl, Aufbau und Inhalt von Fachdatenbanken und sind in der Lage Pubmed und Web of knowledge effizient zu nutzen. Sie sind in der Lage für ihre Bachelor-/Masterarbeit relevante Publikationen zu beziehen, diese sinnvoll zu verwalten und die Referenzen in ihre Arbeit ordnungsgemäß einzufügen.

- Credit Points: 1 CP

– **Special Aspects of Virology** (lecture)
  - KIS identifier: BIO-MGE-99-W-5
  - Teaching staff: Prof. E. Tobiasch (Hochschule Bonn-Rhein-Sieg)
  - Department: Molekulare Genetik,
  - Content: The course focuses on the different viral families with respect to some the following aspects: worldwide infection, the different forms of hepatitis, childhood diseases, viruses and cancer, viruses and gene therapy, "emerging viruses", viral zoonosis, bio terrorism.
  - Credit Points: tbd

Theoretical classes offered by other faculties:

Chemie:

– **Biochemisches Seminar I** (Seminar)
  - KIS identifier: CHE-400-020-V-0
  - Teaching staff: Prof. A. Pierik, Prof. M. Deponte
  - Department: Biochemistry (Faculty Chemistry)
  - Content: Discussion of recent papers in biochemistry
  - Credit Points: tbd

– **Protein Biochemistry** (Lecture)
  - KIS identifier: CHE-400-020-V-0
  - Teaching staff: Prof. M. Deponte
  - Department: Biochemistry (Faculty Chemistry)
  - Content:
    - Amino acid metabolism; protein structure; intracellular protein turnover; synthesis and purification of proteins
  - Credit Points: tbd

– **Microbial Biochemistry** I (Lecture)
  - KIS identifier: CHE-400-082-V-5
  - Teaching staff: Prof. A. Pierik
  - Department: Biochemistry (Faculty Chemistry)
  - Content:
    - Radical SAM enzymes, Glycyl radical enzymes, hydrogenases, oxygen-tolerant hydrogenases, nitrogenases, nitrogenase and symbiosis, methanogenesis, reverse methanogenesis, pyrrolysine, selenocysteine, amino acid fermentation, electron bifurcation, sulfate reduction, (siro)heme biosynthesis, biotechnology: isobutanol production, biotechnology: lysine production
  - Credit Points: tbd

– **Microbial Biochemistry** II (Lecture)
  - KIS identifier: CHE-400-082-V-5

- Teaching staff: Prof. M. Deponte
- Department: Biochemistry (Faculty Chemistry)
- Content:
  - Overview and phylogeny of parasitic protists; special cell organelles and metabolic pathways; molecular parasitology; drug development; resistance mechanisms
- Credit Points: 3

– **Enzymology** (Lecture)
- KIS identifier: CHE-400-085-V-5
- Teaching staff: Prof. M. Deponte
- Department: Biochemistry (Faculty Chemistry)
- Content:
  - Enzyme classification; principles of enzyme catalysis; steady-state and pre-steady state kinetics; reversible and irreversible reactions; enzyme inhibitors; allostery and cooperativity; data analysis and evaluation; selected enzyme mechanisms and examples
- Credit Points: tbd

– **Comparative biochemistry** (Lecture)
- KIS identifier: CHE-400-040-V-5
- Teaching staff: Prof. M. Deponte
- Department: Biochemistry (Faculty Chemistry)
- Content:
  - Organismic diversity, metabolic compartmentalization; comparison of metabolic pathways; analogous and differing reactions; purine and pyrimidine metabolism; eukaryotic and prokaryotic model systems; comparison of pro- and eukaryotes (energy metabolism, information systems, growth and reproduction, defence and immune systems, motility)
- Credit Points: tbd

– **Nucleinsäuren und Proteinbiosynthese (Biochemie III)** (Vorlesung)
- KIS identifier: CHE-400-030-V-1
- Teaching staff: Prof. A. Pierik
- Department: Biochemistry (Faculty Chemistry)
- Content:
  - Struktur und Funktion von Nukleotiden, Chromatin, DNA, RNA, DNA-Reparatur, Telomere; Biosynthese von Desoxynucleotiden, DNA, RNA, Proteinen (Replikation, Transkription (auch revers), Translation); Posttranskriptionale und posttranslationale Prozesse; Regulation der Genexpression auf verschiedenen Stufen; Proteinsortierung; Gentechnik
- Credit Points: tbd

	Sozialwissenschaften: – **Philosophie der Biologie** o KIS identifier: SO-04-7.120-S-1 o Teaching staff: L. Reithmann, M.A. o Department: Philosophie (Faculty Sozialwissenschaften) o Content: Im Seminar soll es um die Problem- u. Fragestellungen der Biologie aus Sicht der Philosophie gehen. Was implizieren biologische Antworten und Methoden für das Selbstverständnis des Menschen? o Credit Points: 2 CP **Wirtschaftswissenschaften:** – **Entrepreneurial Project/ Gründungsprojekt** o KIS identifier: WIW-EPS-GP-W-7 o Teaching staff: PD Dr. G. Fassott o Department: Faculty Wirtschaftswissenschaften o Content: Gründungsinteressierte Studierende vertiefen die Theorien und Konzepte aus dem vorausgesetzten Gründungs-Modul und können diese auf Fragestellungen aus der Praxis übertragen. Für eine konkrete Gründungsidee werden die erforderlichen Schritte und Planungen auf dem Weg zur Unternehmensgründung umgesetzt, insb. aus dem Bereich der Kundenanalyse. o Remarks: http://www.uni-kl.de/entrepreneur o Credit Points: 3 CP
2.	Impact on curriculum: Optional modul
3.	Content: – Topics (and/or methods) of the different departments involved in the Master Programm ‚Biology' and of other faculties. – For a more detailed content of all recommended WM courses please see #1.
4.	Competencies and Intended Learning Outcomes: Competencies: ☒**Professional competence**: – Depending on the courses chosen, the students acquire a deepened and widened practical and theoretical knowledge in various biological and non-biological fields of science and expertise. They enhance their capabilities for scientific discussions and presentations, and improve their methodological and laboratory skills. ☐**Methodological competence**: --- ☐**Social competence**: --- ☒**Self-competence**: – Students acquire inter- and multidisciplinary knowledge and competences, including general competences (soft skills) that are required for professional work.

	Intended Learning Outcomes: On successfully completing the module, students will be able to… – use their increased theoretical and practical skills for various research projects. – discuss interdisciplinary scientific fields. – show increased soft skills during their studies and their professional work.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in biology and related fields
6.	Requirements for receiving credit points: Dependent on the courses chosen: i) Passed examination(s) if applicable incl. or consisting of partial achievements (e.g. discussion contributions, oral presentation, oral or written examinations) and if applicable ii) additional non-graded course achievements (e.g. regular and active attendance, initial tests)	
7.	Determination of grade:	
	Grade:	Non-graded
	Significance for final grade:	---
8.	Applicability of the module/suitability: ---	
9.	Hints for preparation:	
	Recommended literature:	Depending on the courses chosen
	Available documents:	Depending on the courses chosen
10.	Registration procedure: Depending on the courses chosen	
11.	Language: English and/or German	

Synoptical Table of Adavanced Practical Modules 1-3: Choices and their Assignment to the Major Fields of Study

Last updated: July 2019

Title*	Department	Sem.	Major			
			MPBio-tec	MCB	Neuro	Eco
Plant Physiology 2	Pflanzenphysiologie	SS	+			
Plant Physiology 3		SS		+		
Molecular Biotechnology 1**	Molekulare Biotechnologie und Systembiologie	WS	+	+		
Molecular Biotechnology 2		WS	+	+		
Microbiology 2	Mikrobiologie	WS	+			+
Plant Pathology 2	Phytopathologie	SS	+			+
Protein Biophysics	Molekulare Biophysik	SS	+			
Molecular Biophysics**		WS	+			
Cell Biology 1**	Zellbiologie	WS		+		
Cell Biology 2		SS		+		
Molecular Genetics	Molekulare Genetik	WS	+	+		
Biochemistry	Biochemie (FB Chemie)	WS/SS		+		
Neurobiology of Vertebrates 2	Tierphysiologie	WS			+	
Neurobiology of Vertebrates 3		SS			+	
Cellular Neurobiology 1**	Zoologie	WS		+	+	
Cellular Neurobiology 2		WS		+	+	
Cellular Neurobiology 3		WS/SS			+	
Neurochemistry 1**	Humanbiologie und Humangenetik	WS		+	+	
Neurochemistry 2		WS			+	
Molecular Ecology	Ökologie	WS				+
Plant Ecology	Pflanzenökologie und Systematik	SS				+

*Numbers at the end of a title are used as faculty identifier; '1' indicates the major affiliation to Bachelor 'Biologie', while higher numbers are indicating affiliation to Master 'Biology'.

** This practical class generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credit-ed as a VM1/2 or PM/VM 3, extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

Advanced Practical Module 1/2

Code:	Module Coordinator:		Teaching Staff:	
VM 1/2 (Vertiefungsmodul 1/2: Vertiefungspraktikum)	Teachers of the master program 'Biology'		Teachers of the master program 'Biology'	
Workload Total (30 hrs. = 1 CP):	Credit Points (CP):	Recommended Semester:	Duration:	Regular cycle:
360 h	12 CP	1st-3rd semester	1 semester	Annually (WS/SS)

1.	Parts of the module/courses:	Attendance time:	Private Study: (preparation + follow up)	Credit Points (CP):
	a) Practical class with seminar:	Depending on the VM1/2 chosen, generally about 160 h	Depending on the VM1/2 chosen, generally about 200 h	12 CP

In this intensive practical course block, students will work individually or in small teams to learn advanced methods and approaches, and apply those techniques in research-related experiments. At the beginning of the course, the teachers introduce the theoretical background of the methods and the specific research topics of the course, and provide relevant literature. Throughout the course, the students report about the progress of their experiments in discussion groups with the teachers. In the final seminar, they discuss their results in presentations. During or after the course, the students prepare protocols in research-paper or poster style.

Selectable VM 1/2 are depicted in 'Synoptical Table of Advanced Practical Modules 1-3: Choices and their Assignment to the Major Fields of Study' above. Additionally, the updated assorment of VM 1/2 of each semester will be announced timely via internet.

Current assortment of VM 1/2 (Last update July 2019):

Winter semester:

- **VM 1/2: Molecular Biotechnology 1**
  - KIS identifier: BIO-BTE-03-L-7
  - Module coordinator: Prof. M. Schroda
  - Teaching staff: Prof. M. Schroda, PD Dr. G. Erkel, Jun.-Prof. F. Willmund, Dr. F. Sommer, Dr. M. Schulz-Raffelt
  - Department: Molekulare Biotechnologie und Systembiologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Time-course analyses of molecular and physiological responses of the green alga Chlamydomonas reinhardtii. Analysis of cytological parameters, gene and protein expression in response to changes in environmental conditions/gene functions. Cell culture techniques of mammalian

cells, toxicity assays, analysis of signal transduction pathways in eukaryotic cells, analysis of gene expression, reporter gene assays, methods for analyzing the mode of action of drugs.
    - Remarks: The practical class 'Molecular Biotechnology 1' generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credited as a VM1/2 or PM/ VM3, extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

– **VM 1/2: Molecular Biotechnology 2**
    - KIS identifier: BIO-BTE-06-L-7
    - Module coordinator: Prof. M. Schroda, Jun.-Prof. T. Mühlhaus
    - Teaching staff: Prof. M. Schroda, Jun.-Prof. T. Mühlhaus, Dr. F. Sommer
    - Department: Molekulare Biotechnologie und Systembiologie
    - Partial achievements corresponding to #6: 1, 2, 3
    - Requirements: Passed examination of TM1-4 ‚Mass Spectrometry and Deep Sequencing based Strategies in Systems Biology'
    - Brief description: MS-based quantitative proteomics: Quantification of protein abundance and of protein complex stoichiometries in Chlamydomonas cells using label-free quantification, MRM and QconCAT approaches based on stable isotope labeling and quantitative mass spectrometry. Computational proteomics using statistical analysis of quantitative proteomics data sets.

– **VM 1/2: Microbiology 2**
    - KIS identifier: BIO-MBI-04-L-7
    - Module coordinator: Prof. N. Frankenberg-Dinkel
    - Teaching staff: Prof. N. Frankenberg-Dinkel, Dr. S. Zehner
    - Department: Mikrobiologie
    - Partial achievements corresponding to #6: 1, 2, 3
    - Requirements: Passed examination of TM1-4 ‚Molecular Microbiology'
    - Brief description: Enrichment and taxonomic characterization of *Pseudomonas* species; basic cloning techniques, site-directed mutagenesis, recombinant protein production, affinity purification, enzyme assays, introduction and use of molecular graphics software (PyMol), bacteria in biofilms; antibiotic resistence;

– **VM 1/2: Molecular Biophysics**
    - KIS identifier BIO-MBP-01-L-3
    - Module coordinator: Prof. S. Keller
    - Teaching staff: Prof. S. Keller
    - Department: Molekulare Biophysik
    - Partial achievements corresponding to #6: 1, 2, 3
    - Requirements: -
    - Brief description: Protein structure, protein-ligand interactions, enzyme kinetics, lipid membranes, membrane transport, spectroscopy, calorimetry, electro physiology, data analysis

- Remarks: The practical class 'Molecular Biophysics' generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credited as a VM1/2 or PM/ VM 3, extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

– **VM 1/2: Cell Biology 1**
  - KIS identifier: BIO-ZBI-01-L-4
  - Module coordinator: Prof. J. Herrmann
  - Teaching staff: Prof. J. Herrmann
  - Department: Zellbiologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Baker's yeast as a model organism, basic techniques in cell growth analysis, measuring growth on solid and in liquid media with different carbon sources, basics in cellular metabolism, respiration and fermentation, diauxic shift, quantitative and qualitative analysis of different stress factors such as metals, temperature, toxic chemicals and oxidants, preparation of cell extracts, working under sterile conditions, preparation of buffers and media, SDS-PAGE, Western blot, quantification of signals, use of online databases such as SGD, PubMed and NCBI, BLAST searches and sequence alignments, presentation of scientific data, basics of scientific writing. Good scientific practice.
  - Remarks: The practical class 'Cell Biology 1' generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credited as a VM1/2 or PM/ VM 3 extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

– **VM 1/2: Molecular Genetics**
  - KIS identifier: BIO-MGE-01-L-7
  - Module coordinator: Prof. Z. Storchová
  - Teaching staff: Prof. Z. Storchová, Dr. M. Räschle
  - Department: Molekulare Genetik
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: Passed examination of TM1-4 'Genetics, Genomics and Epigenetics'
  - Brief description: Mammalian cell cultures as a model system, working under sterile conditions, preparation of buffers and media, basic techniques for culturing of human cell lines, site-directed mutagenesis, construction of a vector carrying a mutated gene, plasmid purification, DNA sequencing, cell transfection, cell growth analysis, quantitative and qualitative analysis of cellular response to different stress factors such as DNA damage agents or overexpression of mutant protein, RNAi, flow cytometry, preparation of cell lysates, SDS-PAGE, Western blot, quantification of complex biological data, use of online databases such as PubMed and NCBI, BLAST searches and sequence alignments, presentation of scientific data, basics of scientific writing; good scientific practice.

- **VM 1/2: Biochemistry 3&4**
  - KIS identifier: tbd
  - Module coordinator: Prof. A. Pierik, Prof. M. Deponte
  - Teaching staff: Prof. A. Pierik, Prof. M. Deponte
  - Department: Biochemie (FB Chemie)
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: Safety briefing of the Chemical Department; tbd
  - Brief description: 1) Metalloprotein expression and characterization with chemical and biophysical methods (in the chemistry department, or in collaboration with colleagues in physics and biology departments). Anaerobic handling of proteins. Enzymology of bacterial metalloproteins, synthesis of substrates and NMR spectroscopic analysis. Cell biological methods pertaining to metalloproteins in yeast (screens, expression, localization). Bioinformatic analysis of metalloproteins and structural modelling. 2) Enzymology and parasitology. Structure-function relation of redox enzymes and glyoxylases. Cell biological methods with Plasmodium and Leishmania (expression, localization).

- **VM 1/2: Neurobiology of Vertebrates II**
  - KIS identifier: BIO-TPH-05-L-7
  - Module coordinator: Prof. E. Friauf
  - Teaching staff: Prof. E. Friauf
  - Department: Tierphysiologie
  - Partial achievments corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Students work in small teams (group size ~3). They acquire in-depth knowledge in experimental methods and selected research topics within the field of Neurobiology. They learn to design, perform and analyze scientific ex-periments. They learn to present, interpret, and discuss their experimental data in written and oral form (protocol, poster, talk). Topics: anatomical, physiological, and molecular principles in the mammalian brain: 1. Analysis of basic neuronal functions via single-cell electrophysiology (patch-clamp recordings) in acute brain slices. 2. Analysis of proteins by immunohistochemistry and/or proteomics. 3. Data analysis and graphing with state-of-the art software. Contact time of this course will be five weeks (~200 h) in the laboratory. In addition, there will be a contact time of 10 h for the seminar. In total, home assignments will comprise another ~160 h.
  - Remarks: Accompanaying lecture/seminar is called 'Brain physiology' and is also attended by students from other programs (e.g. B.Sc. Biologie, M.Sc. Biophysik)

- **VM 1/2: Cellular Neurobiology 1**
  - KIS identifier: BIO-ZOO-03-L-3
  - Module coordinator: Prof. J. Pielage
  - Teaching staff: Prof. J. Pielage, Dr. A. Thyssen

- Department: Zoologie
- Partial achievements corresponding to #6: 1, 2, 3
- Requirements: -
- Brief description: Introduction into research in cellular neurobiology using the model organism *Drosophila melanogaster*; Introduction into Drosophila genetics, preparation techniques of neuromuscular junctions; Analysis of cellular neurobiology using immunohistological techniques; Introduction into fluorescence and confocal laser scanning microscopy; Analysis and characterization of essential synaptic genes using methods and techniques learned in the course.
- Remarks: The practical class 'Cellular Neurobiology 1' generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credited as a VM1/2 or PM/ VM 3, extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

– **VM 1/2: Cellular Neurobiology 2**
  - KIS identifier: BIO-ZOO-11-L-7
  - Module coordinator: Prof. J. Pielage
  - Teaching staff: Prof. J. Pielage, Dr. A. Thyssen
  - Department: Zoologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: The goal of this course is to introduce research on circuit neurobiology to the students. Students will work in small teams (group size of 2-3 people) and independently conduct a research project. This includes writing of a scientific proposal, perform and analyze scientific experiments and presentation of results in oral and written form (presentation and proposal). Topic: Structure and function of a Drosophila sensory-motor circuit. A variety of methods will be applied to: 1. Analyze and quantify animal behavior. 2. Genetically control and manipulate individual neurons within a circuit using opto- and thermogenetic methods. 3. Relate neuronal morphology to function using immunohistological methods and confocal microscopy.

– **VM 1/2: Cellular Neurobiology 3**
  - KIS identifier: BIO-ZOO-12-L-7
  - Module coordinator: Prof. J. Pielage
  - Teaching staff: Prof. J. Pielage
  - Department: Zoologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: The goal of this course is to introduce modern methods of neurobiology to the students. Students will work independently or in small teams. Students will scientific proposal, perform and analyze scientific experiments and presentation of results in oral and written form (presentation and proposal). The course addresses modern questions of Drosophila neurobiology. Topics include: 1. Analysis of synapse formation and stability; 2.

Analysis of neuronal circuits 3. Analysis of animal behavior including learning and memory; Methods include: Drosophila genetics (including opto- and thermogenetic methods), molecular and cell biology of the neuron, immunohistochemical analysis, high-resolution confocal microscopy, genetic screens

- **VM 1/2: Neurochemistry 1**
  - KIS identifier: BIO-HUM-03-L-3
  - Module coordinator: Prof. S. Kins
  - Teaching staff: Prof. S. Kins, Dr. S. Eggert
  - Department: Humanbiologie und Humangenetik
  - Partial performances corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: In this practical course you will learn basic molecular biological methods, including DNA preparation, cloning, transformation, transfection. Further you will perform basic biochemical studies, encompassing protein affinity purification (GST, His), differential centrifugation of membrane compartments, PAGE, Western Blot and immunocytochemical studies.
  - Remarks: The practical class 'Neurochemistry 1' generally belongs to the Bachelor Program 'Biologie' and is compensated with 10 CP. To be credited as a VM1/2 or PM/ VM 3, extra achievements (≙ 2 CP) have to be realized, as indicated by the module coordinator.

- **VM 1/2: Neurochemistry 2**
  - KIS identifier: BIO-HUM-01-L-7
  - Module coordinator: Prof. S. Kins
  - Teaching staff: Prof. S. Kins, Dr. S. Eggert
  - Department: Humanbiologie und Humangenetik
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Molecular and cellular biology of neuronal cells. Neuronal cell culture, Protein purification, Immunocytochemistry, Immunohistochemistry, Live Cell Imaging.

- **VM 1/2: Molecular Ecology**
  - KIS identifier: BIO-ÖKO-04-L-4
  - Module coordinator: Prof. T. Stoeck, Jun.-Prof. S. Filker
  - Teaching staff: Prof. T. Stoeck, Jun.-Prof. S. Filker
  - Department: Ökologie & Molekulare Ökologie
  - Partial achievements corresponding to #6: 4; plus additional non-graded course achievements like written proctocol, oral presentation of the results
  - Requirements: -
  - Brief description: Characterization of microbial communities and relation of these communities to their natural habitats. Focus will be on unicellular eukaryotes. Samples will be taken by students during a field trip (such as the Wadden Sea, Sylt). In the field, a detailed habitat characterization will be conducted for sampling sites. Samples (such as water or sediment) will be

prepared in the field for detailed analyses in the lab. Among others, nucleic acids of microbial communities will be extracted from environmental samples, followed by targeted PCR of taxonomic marker gene regions, quantitative RT-PCR of cDNA to quantify specific functional microbial processes, high-throughput sequencing, computational massive sequence data processing and community statistical analyses (using for example the program package R). These data will then be placed in context to environmental habitat characteristics to explain organism-environment relationships and the occurrences of specific microbes in specific habitats. Further techniques will include for example flow-cytometry, epifluorescence microscopy, single-cell PCR and phylogeny.

Summer semester:

- **VM 1/2: Plant Physiology 2**
  - KIS identifier: BIO-PPH-05-L-7
  - Module coordinator: Prof. E. Neuhaus
  - Teaching staff: Prof. E. Neuhaus, Dr. O. Trentmann, Dr. I. Haferkamp
  - Department: Pflanzenphysiologie
  - Partial achievments corresponding to #6: 1, 2, 3
  - Requirements: Regular and active attendance of TM1-4 ‚Plant Biotechnology'
  - Brief description: Section 1: Recombinant expression and "tag-based" purification of a membrane protein; reconstitution of this membrane protein into lipid vesicles for biochemical characterization. Section 2: Northern blot-based analysis to investigate gene expression of a tonoplast protein from Arabidopsis; analysis of the subcellular localization by the use of green fluorescent protein fusions. Section 3: Isolation of intact vacuoles from Arabidopsis and investigation of the relevance of this organelle in cold adaptation.

- **VM 1/2: Plant Physiology 3**
  - KIS identifier: N.N.
  - Module coordinator: Prof. E. Neuhaus
  - Teaching staff: Prof. E. Neuhaus, Dr. T. Möhlmann
  - Department: Pflanzenphysiologie
  - Partial achievments corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Cloning and expression of plant genes in expression systems like Bacteria, Yeast and plant cells for functional analysis. Analysis of the subcellular localization of membrane proteins by use of GFP fusion constructs. Analysis of plants and plant mutants under stress (cold, high light) or starvation conditions.

- **VM 1/2: Plant Pathology 2**
  - KIS identifier: BIO- PPA-02-L-7
  - Module coordinator: Prof. M. Hahn
  - Teaching staff: Prof. M. Hahn, Dr. D. Scheuring

- Department: Phytopathologie
- Partial achievements corresponding to #6: 1, 2, 3
- Requirements: Successful participation of Plant Pathology 1, or passed examination of TM1-4 ‚Pathogenic Plant-Fungus Interactions'
- Brief description: Molecular biology of plant pathogenic fungi: Mutational analysis of infection mechanisms of *Botrytis cinerea*. Characterization of phytotoxic fungal proteins and their interference with the plant immune system. Cytological investigation of the fungal infection andand plant defence mechanisms.

– **VM 1/2: Protein Biophysics**
  - KIS identifier: BIO- MBP-02-L-3
  - Module coordinator: Prof. S. Keller
  - Teaching staff: Prof. S. Keller
  - Department: Molekulare Biophysik
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: Passed examination of TM1-4 'Protein Biophysics'
  - Brief description: *In vitro* and *in silico* approaches to proteins: Functional protein refolding, enzyme activity assays, and protein characterization by chromatography, static and dynamic light scattering, absorbance and fluorescence spectroscopy, and differential gel migration. Data analysis by nonlinear least-squares regression and visualization of protein structures with the aid of computer programs. Scientific writing and data presentation in written and oral forms.

– **VM 1/2: Cell Biology 2**
  - KIS identifier: BIO-ZBI-02-L-7
  - Module coordinator: Prof. J. Herrmann
  - Teaching staff: Prof. J. Herrmann
  - Department: Zellbiologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: Successful participation in Cell Biology 1
  - Brief description: Basic techniques in yeast genetics, isolation of mutants, analysis of different growth phenotypes, synthetic and complex growth media, cell fractionation and isolation of organelles, in vitro transcription and translation, working with radioactivity, protein import experiments into isolated mitochondria with radiolabeled precursor proteins, analysis of protein translation, SDS-PAGE, Western blotting, autoradiography, data analysis and signal quantification with ImageJ, use of online databases such as SGD, PubMed and NCBI, BLAST searches and sequence alignments, presentation of scientific data, basics of scientific writing and poster presentations. Good scientific practice

– **VM 1/2: Biochemistry 3&4**
  - KIS identifier: tbd
  - Module coordinator: Prof. A. Pierik & Prof. M. Deponte

- Teaching staff: Prof. A. Pierik & Prof. M. Deponte
- Department: Biochemie (FB Chemie)
- Partial achievements corresponding to #6: 1, 2, 3
- Requirements: Safety briefing of the Chemical Department; tbd
- Brief description: 1) Metalloprotein expression and characterization with chemical and biophysical methods (in the chemistry department, or in collaboration with colleagues in physics and biology departments). Anaerobic handling of proteins. Enzymology of bacterial metalloproteins, synthesis of substrates and NMR spectroscopic analysis. Cell biological methods pertaining to metalloproteins in yeast (screens, expression, localization). Bioinformatic analysis of metalloproteins and structural modelling. 2) Enzymology and parasitology. Structure-function relation of redox enzymes and glyoxylases. Cell biological methods with Plasmodium and Leishmania (expression, localization).

– **VM 1/2: Neurobiology of Vertebrates III**
  - KIS identifier: BIO-TPH-08-L-7
  - Module coordinator: Prof. E. Friauf
  - Teaching staff: Prof. E. Friauf
  - Department: Tierphysiologie
  - Partial achievements corresponding to #6: 1, 2, 3
  - Requirements: -
  - Brief description: Students work in small teams (group size ~3). They acquire in-depth knowledge in experimental methods and selected research topics within the field of Neurobiology. They learn to design, perform and analyze scientific experiments. They learn to present, interpret, and discuss their experimental data in written and oral form (protocol, poster, talk). Topics: anatomical, physiological, and molecular principles in the mammalian brain: 1. Analysis of basic neuronal functions via single-cell electrophysiology (patch-clamp recordings) in acute brain slices. 2. Analysis of proteins by immunohistochemistry and/or proteomics. 3. Data analysis and graphing with state-of-the art software. Contact time of this course will be five weeks (~200 h) in the laboratory. In addition, there will be a contact time of 10 h for the seminar. In total, home assignments will comprise another ~160 h.
  - Remarks: Accompanaying lecture/seminar is called 'Synaptic Plasticity (and Homeo-stasis)' and is also attended by students from other programs (e.g. B.Sc. Biologie, M.Sc. Biophysik); Students that have already successfully taken VM1/2 'Neurobiology of Vertebrates 2' (BIO-TPH-03-L-7) will be taught at a conceptually and technically advanced level or achieve training in a neighboring field. For example electrophysiology will be applied at a more sophisticated level, or will be complemented by molecular biology/protein analysis.

– **VM 1/2: Cellular Neurobiology 3**
  - KIS identifier: BIO-ZOO-12-L-7
  - Module coordinator: Prof. J. Pielage
  - Teaching staff: Prof. J. Pielage

	○ Department: Zoologie ○ Partial achievements corresponding to #6: 1, 2, 3 ○ Requirements: - ○ Brief description: The goal of this course is to introduce modern methods of neurobiology to the students. Students will work independently or in small teams. Students will scientific proposal, perform and analyze scientific experiments and presentation of results in oral and written form (presentation and proposal). The course addresses modern questions of Drosophila neurobiology. Topics include: 1. Analysis of synapse formation and stability; 2. Analysis of neuronal circuits 3. Analysis of animal behavior including learning and memory; Methods include: Drosophila genetics (including opto- and thermogenetic methods), molecular and cell biology of the neuron, immunohistochemical analysis, high-resolution confocal microscopy, genetic screens – **VM 1/2: Plant Ecology** ○ KIS identifier: BIO-PÖS-02-L-7 ○ Module coordinator: Dr. R. Wirth ○ Teaching staff: Dr. R. Wirth, Dr. L. Briegel-Williams, N. Kunz ○ Department: Pflanzenökologie und Systematik ○ Partial achievements corresponding to #6: 1, 2, 3 ○ Requirements: - ○ Brief description: This field course will take place in a floristically rich, native ecosystem with interesting plant, community and landscape ecological features. It consists of a 1-wk field campaign (with overnight tent camping) and 2 wks of lab work, statistical analyses, and presentations. Our teaching concept emphasizes the scientific process, bridging ecological theory with methods and study design. This is deepened in individual scientific projects fully developed by the students.Key topics involve: biodiversity and ecosystem function in semi-arid grasslands, community composition and plant functional traits, species interactions, ecophysiology of photosynthesis and water relations, adaption and acclimation, biomass partitioning and allocation, environmental filtering, anthropogenic disturbance and ecology of vegetation regeneration.
2.	Impact on curriculum: Elective Module
3.	Content: – Topics and methods of the different departments involved in the Master Programm ‚Biology'. – For a more detailed content of all selectabele VM1/2 please see #1.
4.	Competencies and Intended Learning Outcomes: Competencies: ☒**Professional competence**: – The students acquire a deepened knowledge in experimental methods and selected research topics (depending on the chosen VM1/2).

<table>
<tr><td></td><td colspan="2">
– They learn to perform, under supervision, the planning and performance of experiments according to the rules of good scientific practice.
– They are able to present, interpret and discuss their experimental data in a written and oral form.

☒Methodological competence:
– Ability to understand and successfully apply experimental methods in biological research.

☒Social competence:
– Ability to work in teams on scientific projects, to discuss methods, research concepts and experimental results

☒Self-competence:
– Responsibility and competence in performing and discussing experimental research.

Intended Learning Outcomes:
On successfully completing the module, students will be able to…
- acquire methods and to apply them successfully in experiments.
- follow the rules of good scientific practice.
- critically evaluate, present (in oral or written form) and discuss own research data.
</td></tr>
<tr><td>5.</td><td colspan="2">Prerequisites for attending:</td></tr>
<tr><td></td><td>Formal admission requirements:</td><td>Admission to the Master Program ‘Biology’</td></tr>
<tr><td></td><td>Contentual prerequisites:</td><td>Bachelor-grade knowledge in biology and related fields</td></tr>
<tr><td>6.</td><td colspan="2">Requirements for receiving credit points:
i) Passed examination consisting of the following partial achievements: 1=practical performance during the course, 2=submission of a written protocol and/or poster, 3=oral presentation of the results, 4=written examination and ii) additional non-graded course achievements: regular and active attendance</td></tr>
<tr><td>7.</td><td colspan="2">Determination of grade:</td></tr>
<tr><td></td><td>Grade:</td><td>Result of the examination consisting of partial achievements</td></tr>
<tr><td></td><td>Significance for final grade:</td><td>12/87</td></tr>
<tr><td>8.</td><td colspan="2">Applicability of the module/suitability:
– For applicability please see ‘Synoptical Table of Advanced Practical Modules 1-3: Choices and their Assignment to the Major Fields of Study’ above.
– VM1 and VM2 are equivalent to each other. The courses offered for VM1 and VM2 can also be taken for PM/ VM 3.
– Selected VM1/2 can also be attended by students of the Master Program ‘Biophysics’.</td></tr>
<tr><td>9.</td><td colspan="2">Hints for preparation:</td></tr>
<tr><td></td><td>Recommended literature:</td><td>Depending on the VM1/2 chosen; generally: will be provided during an orientation meeting</td></tr>
</table>

	Available documents:	Depending on the VM1/2 chosen; generally: will be provided during an orientation meeting
10.	Registration procedure: Depending on the VM1/2 chosen	
11.	Language: English and/or German	

<table>
<tr><th colspan="7">Practical Module or Advanced Practical Module 3: Industrial Traineeship or Practical Class</th></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td colspan="2">PM/ VM 3
(Praxismodul oder Vertiefungsmodul 3: Industrie- oder Vertiefungspraktikum)</td><td colspan="2">Teachers of the Master Program ‘Biology’</td><td colspan="3">Teachers of the Master Program ‘Biology’</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td colspan="2">Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">360 h</td><td>12 CP</td><td>1st-3rd semester</td><td colspan="2">1 semester</td><td>Annually (WS/SS)</td></tr>
<tr><td rowspan="2">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td colspan="2">Industrial Traineeship
OR
Practical class with seminar</td><td>Depending on the PM/ VM 3 chosen</td><td>Depending on the PM/ VM 3 chosen</td><td>Depending on the PM/ VM 3 chosen</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Elective module</td></tr>
<tr><td>3.</td><td colspan="5">Content:
In this intensive practical course block, students will work individually or in small teams to learn advanced methods and approaches, and apply these techniques in research-related experiments. At the beginning of the practical class, the teachers introduce the theoretical background of the methods and the specific research topics of the course, and provide relevant literature. Throughout the class, the students report about the progress of their experiments in discussion groups with the teachers. In the final seminar, they discuss their results in presentations. During or after the course, the students prepare protocols in research-paper or poster style.
Practical classes can be chosen from the catalogues listed as VM1/2. Practicals in other departments or research institutions in Germany or other countries, as well as Industrial Traineeships (see below), are also possible, if agreed by the coordinators of the major fields of study.
Industrial Traineeships are performed in a company or a public institution, under the supervision of a professor engaged in this Master program. Before the industrial traineeship is started, the student has to present to the supervising professor a one-page project outline signed by himself and the supervisor of the traineeship in the company. After the traineeship, the student documents the results in a written protocol, and in an oral presentation with discussion in the presence of the supervising professor.</td></tr>
</table>

4.	Competencies and Intended Learning Outcomes: Competencies: ☒**Professional competence**: – The students acquire a deepened knowledge in experimental methods and selected research topics offered during the practical. They learn to perform, under supervision, the planning and performance of experiments according to the rules of good scientific practice. They are able to present, interpret and discuss their experimental data in a written and oral form. ☒**Methodological competence**: – Ability to understand and successfully apply experimental methods in biological research. ☒**Social competence**: – Ability to work in teams on scientific projects, to discuss methods, research concepts and experimental results. ☒**Self-competence**: – Responsibility and competence in performing and discussing experimental research Intended Learning Outcomes: On successfully completing the module, students will be able to… – acquire methods and to apply them successfully in experiments. – follow the rules of good scientific practice. – critically evaluate, present (in oral or written form) and discuss own research data.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to the Master Program 'Biology'
	Contentual prerequisites:	Bachelor-grade knowledge in biology and related fields
6.	Requirements for receiving credit points: Depending on the PM/ VM 3 chosen – Industrial Traineeship: Non-graded course achievements (if applicable): regular and active attendance, practical performance during the course, written protocol and/or poster, oral presentation of the results – Practical Class: i) Passed examination consisting of the following partial achievements: 1=practical performance during the course, 2=submission of a written protocol and/or poster, 3=oral presentation of the results and ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Non-graded
	Significance for final grade:	---

8.	Applicability of the module/suitability: ---	
9.	Hints for preparation:	
	Recommended literature:	Depending on the PM/ VM 3 chosen; generally: will be provided during an orientation meeting
	Available documents:	Depending on the PM/ VM 3 chosen; generally: will be provided during an orientation meeting
10.	Registration procedure: Depending on the PM/ VM 3 chosen	
11.	Language: English and/or German	

<table>
<tr><th colspan="7">Research Practical</th></tr>
<tr><td colspan="2">Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td colspan="2">FM (Forschungs-modul)</td><td colspan="2">Teachers of the Master program ‘Biol-ogy’</td><td colspan="3">Teachers of the Master program ‘Biol-ogy’</td></tr>
<tr><td colspan="2">Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td colspan="2">Duration:</td><td>Regular cycle:</td></tr>
<tr><td colspan="2">450 h</td><td>15 CP</td><td>3rd semester</td><td colspan="2">1 Semester</td><td>By agreement</td></tr>
<tr><td rowspan="3">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (prep-aration + fol-low up)</td><td colspan="2">Credit Points (CP):</td></tr>
<tr><td>a) Practical:</td><td>Research Practical</td><td>380 h</td><td>55 h</td><td colspan="2">14.5 CP</td></tr>
<tr><td>b) Seminar:</td><td>Accompanying Seminar</td><td>2 h</td><td>13 h</td><td colspan="2">0.5 CP</td></tr>
<tr><td>2.</td><td colspan="6">Impact on curriculum:
Elective module, to be fulfilled in one of the groups that are involved in the chosen major field of study</td></tr>
<tr><td>3.</td><td colspan="6">Content:
– In this intensive individual practical, the students learn methods and are introduced into scientific research topics that are investigated in the groups involved in the study program. The research practical is usually performed in the same group in which the Master thesis is performed. It can serve as a practical and theoretical preparation for the Master Thesis. The practical is terminated by an oral presentation of the experimental results and submission of a written report.</td></tr>
<tr><td>4.</td><td colspan="6">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– Performing scientific work on a research project using current methods, and data analysis.
– Planning and execution of experiments with an increasing degree of independence.
– Increasing ability for evaluation, interpreting, presenting and critically discussing ex-perimental results in an oral presentation and a written research report.
☒Methodological competence:
– Ability to understand and successfully apply experimental methods in biological re-search.
☐Social competence: ---
☒Self-competence:
– Working individually in a research laboratory, self-responsible interaction with super-visors and colleagues</td></tr>
</table>

	Intended Learning Outcomes: On successfully completing the module, students will be able to… – use their practical skills for performing research projects.	
5.	Prerequisites for attending:	
	Formal admission requirements:	Admission to Master Program 'Biology'
	Contentual prerequisites:	Experience to design and perform experiments individually and with a significant degree of independence. Knowledge of the theoretical background of the experiments and their underlying research project.
6.	Requirements for receiving credit points: i) Passed examination consisting of the following partial achievements: practical performance during the course, submission of a written report, oral presentation of the results and ii) additional non-graded course achievements: regular and active attendance	
7.	Determination of grade:	
	Grade:	Result of the examination consisting of partial achievements
	Significance for final grade:	15/87
8.	Applicability of the module/suitability: ---	
9.	Hints for preparation:	
	Recommended literature:	Depending on the FM chosen, generally will be provided at or prior to the beginning of the course
10.	Registration procedure: Depending on the FM chosen	
11.	Language: English and/or German	

<table>
<tr><th colspan="6">Master Thesis</th></tr>
<tr><td>Code:</td><td colspan="2">Module Coordinator:</td><td colspan="3">Teaching Staff:</td></tr>
<tr><td>MT</td><td colspan="2">Teachers of the Master program ‘Biology’</td><td colspan="3">Teachers of the Master program ‘Biology’</td></tr>
<tr><td>Workload
Total (30 hrs. = 1 CP):</td><td>Credit Points (CP):</td><td>Recommended Semester:</td><td>Duration:</td><td colspan="2">Regular cycle:</td></tr>
<tr><td>Number of hours
900 h</td><td>Number of CP
30 CP</td><td>Which semester
4th semester</td><td>No of semesters
1 Semester</td><td colspan="2">Frequency
By agreement</td></tr>
<tr><td rowspan="3">1.</td><td colspan="2">Parts of the module/courses:</td><td>Attendance time:</td><td>Private Study: (preparation + follow up)</td><td>Credit Points (CP):</td></tr>
<tr><td colspan="2">Thesis (experimental work)</td><td>720 h</td><td>165 h</td><td>29.5 CP</td></tr>
<tr><td colspan="2">Master Thesis Presentation</td><td>2 h</td><td>13 h</td><td>0.5 CP</td></tr>
<tr><td>2.</td><td colspan="5">Impact on curriculum:
Compulsory module, to be fulfilled in one of the groups that are involved in the chosen major field of study</td></tr>
<tr><td>3.</td><td colspan="5">Content:
– Performing research on a scientific project in a group of the Faculty of Biology that is engaged in this Master program. The work is completed by a lecture during the seminar series ‘Master Project Presentations’ and by submission of the Master Thesis document.</td></tr>
<tr><td>4.</td><td colspan="5">Competencies and Intended Learning Outcomes:
Competencies:
☒Professional competence:
– After successful completion of the Master Thesis, students have acquired profound practical skills in state-of-the-art concepts and methods used in their chosen research direction.
– They are acquainted with current research and recent publications in this field.
– They are trained in compiling and analyzing data for a scientific paper and in writing a scientific report.
☒Methodological competence:
– Ability to understand and successfully apply experimental methods in biological research.
☐Social competence: ---
☒Self-competence:</td></tr>
</table>

	– The students have acquired soft skills, such as time and project management, working in interdisciplinary teams, English communication and writing skills, and rules of responsible conduct of research. Intended Learning Outcomes: On successfully completing the module, students will be able to… – use of practical and theoretical skills for performing independently research projects, for example as PhD students or in laboratories in the private or public sector.	
5.	Prerequisites for attending:	
	Formal admission requirements:	– Admission to Master program 'Biology' – Successful completion of the practical modules and the research practical and ≥ 78 CP
	Contentual prere-quisites:	– Theoretical and practical experience and skills to design and perform experiments individually, with a significant degree of independence. – Knowledge of the theoretical background of the experiments and their underlying research project.
6.	Requirements for receiving credit points: i) Submission of the written Master Thesis and ii) additional non-graded course achieve-ments: oral presentation of the results	
7.	Determination of grade:	
	Grade:	Written Master Thesis
	Significance for final grade:	30/87
8.	Applicability of the module/suitability: ---	
9.	Hints for preparation:	
	Recommended literature:	Provided at or prior to the beginning of the thesis work
10.	Registration procedure: According to prior agreement with the supervisior	
11.	Language: English and/or German	