

Translation

Amendment to and Reannouncement
of the Examination Regulations
for the Consecutive Master's Degree Program

**“Microbiology, Molecular Cell Biology, Organismic Biology,
Evolutionary Biology and Palaeobiology (OEP Biology) and Plant
Sciences”**

at the Faculty of Mathematics and Natural Sciences of the
University of Bonn

This document is an official translation of the Examinations
Regulations published in Amtl. Bek. der Universität Bonn,
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Please note that only the original German version is legally
binding.

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of the Examination Regulations
for the Consecutive Master's Degree Programs**

“Microbiology,

Molecular Cell Biology,

Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology)

and

Plant Sciences”

**of the Faculty of Mathematics and Natural Sciences
of the University of Bonn
dated**

March 17, 2021

This translation is provided solely for informational purposes. Only the German original is legally binding.

By virtue of § 2, para. 4 and § 64, para. 1 of the NRW Higher Education Act (*Gesetz über die Hochschulen des Landes Nordrhein-Westfalen, Hochschulgesetz, HG*) of September 16, 2014 (Legal and Regulatory Gazette of North Rhine-Westphalia, p. 547) as last amended by Article 1 of the Act Concerning Further Measures for Management of the Coronavirus Pandemic in Higher Education Institutions (*Gesetz hinsichtlich weiterer Maßnahmen zur Bewältigung der Corona-Pandemie im Hochschulbereich*), dated December 1, 2020 (Legal and Regulatory Gazette of North-Rhine Westphalia, p. 1110), the Faculty of Mathematics and Natural Sciences of the University of Bonn issued the following Examination Regulations:

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Part 1
Scope

§ 1
Scope

(1) Students who commence their studies in one of the consecutive master's degree programs Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology), Microbiology, Molecular Cell Biology (previously Molecular Biology and Biotechnology) and Plant Sciences at the University of Bonn after entry into force of these Examination Regulations are subject to these Examination Regulations.

(2) The examination regulations of the Faculty of Mathematics and Natural Sciences at the University of Bonn for the following consecutive master's degree programs will be repealed as of September 30, 2023:

- the Examination Regulations for the consecutive master's degree program Plant Sciences of July 9, 2008 (Official Announcement of the University of Bonn, Year 23, No. 23 of July 11, 2008) as last amended by the Second Amendment to the Examination Regulations for the consecutive master's degree program Plant Sciences of July 17, 2014 (Official Announcement of the University of Bonn, Year 44, No. 19 of July 18, 2014), hereinafter referred to as MPO PlantSci 2008
- the Examination Regulations for the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) of October 14, 2011 (Official Announcement of the University of Bonn, Year 41, No. 29 of October 19, 2011) as last amended by the Amendment to the Examination Regulations for the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) of July 17, 2014 (Official Announcement of the University of Bonn, Year 44, No. 19 of July 18, 2014), hereinafter referred to as MPO OEP 2011
- the Examination Regulations for the consecutive master's degree program Molecular Biotechnology of August 31, 2012 (Official Announcement of the University of Bonn, Year 42, No. 46 of September 6, 2012) as last amended by the Amendment to the Examination Regulations for the consecutive master's degree program Molecular Biotechnology (now Molecular Biology and Biotechnology) of July 17, 2014 (Official Announcement of the University of Bonn, Year 44, No. 19 of July 18, 2014), hereinafter referred to as MPO MolBio 2012
- the Examination Regulations for the consecutive master's degree program Microbiology of August 1, 2011 (Official Announcement of the University of Bonn, Year 41, No. 24 of August 4, 2011) as last amended by the Amendment to the Examination Regulations for the consecutive master's degree program Microbiology of July 17, 2014 (Official Announcement of the University of Bonn, Year 44, No. 19 of July 18, 2014), hereinafter referred to as MPO Microbio 2011

Examinations in accordance with MPO PlantSci 2008, MPO OEP 2011, MPO MolBio 2012 and MPO Microbio 2011 will be admissible until September 30, 2022. The examination board may extend this period by six months upon valid request.

(3) Students who, having commenced their studies prior to the coming into force of these Examination Regulations, are subject to MPO PlantSci 2008, MPO MolBio 2012, MPO OEP 2011 or MPO Microbio 2011 and have not yet completed all necessary examinations, may

- a. continue their studies under MPO PlantSci 2008, MPO MolBio 2012, MPO OEP 2011 or MPO Microbio 2011 until the deadline stated in para. 2 or
- b. irrevocably adopt these Examination Regulations by written request.

Students who continue their studies under MPO PlantSci 2008, MPO MolBio 2012, MPO OEP 2011 or MPO Microbio 2011 and do not graduate by September 30, 2022 shall adopt these Examination Regulations ex officio on October 1, 2022. Credit for prior academic achievements shall be granted. Para. 2 sentence 3 shall remain unaffected; these Examination Regulations shall then be adopted ex officio on April 1, 2023.

§ 1a
Coronavirus pandemic

If the Rectorate has made use of the authorization to issue provisions concerning academic studies that it was granted under the Ordinance on Overcoming Coronavirus SARS-CoV-2 Epidemic-Related Challenges Posed on University Operations (*Corona-Epidemie-Hochschulverordnung*) dated April 15, 2020, as amended, which was issued based on § 82a of the NRW Higher Education Act, the provisions issued by the Rectorate shall supersede the corresponding provisions in these Examination Regulations.

Part 2
Program objective, degree and standard period of study

§ 2
Objective of the degree program and purpose of the examination

- (1) The consecutive master's degree programs Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) and Plant Sciences are offered by the Faculty of Mathematics and Natural Sciences. The consecutive master's degree programs Microbiology and Molecular Cell Biology are offered jointly by the Faculty of Mathematics and Natural Sciences, the Faculty of Agriculture and the Faculty of Medicine under the leadership of the Faculty of Mathematics and Natural Sciences of the University of Bonn. All four master's degree programs are international and research-oriented.
- (2) Students in these master's degree programs are to acquire the necessary scientific knowledge, skills and methods as well as relevant key qualifications for an occupation in the field, enabling them to conduct sound research, to critically assess and practically apply research findings and methods as well as to act responsibly. This includes giving due regard to changes and requirements in the working world and, if applicable, in cross-disciplinary references. The program objectives mainly focus on
 - building expert knowledge regarding current research by expanding the students' basic knowledge;
 - building methodical and analytical competences, enabling students to expand their research findings on their own authority, with a strong emphasis on research methods and strategies.
- (3) Students are to learn how to approach complex problems and work on their solution beyond the existing scope of knowledge using research methods and to critically question and assess results.
- (4) The master's examination shall lead to conferral of a master's degree in Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology), Microbiology, Molecular Cell Biology or Plant Sciences, which qualifies the holder for positions demanding extensive skills in that field.

§ 3
Academic degree

Candidates who successfully complete the master's examination for the chosen degree program shall be awarded a Master of Science (MSc) degree by the Faculty of Mathematics and Natural Sciences of the University of Bonn.

§ 4
Standard period of study, ECTS credit point system, range of courses, program structure and language of instruction/examinations

- (1) The standard period of study, including the master's thesis, is four semesters (120 ECTS CP) when pursuing the degree program full-time.

- (2) The contents of the degree program are selected and limited in a manner that the master's examination can be completed within the standard period of study. They are organized in modules that, as a rule, consist of courses with a thematic, methodical or systematic connection.
- (3) As a rule, each module is completed by passing a module examination, awarding credit points (CP) in accordance with the European Credit Transfer and Accumulation System (ECTS). One ECTS credit point is equivalent to a calculated student workload in contact hours and self-learning of 30 hours.
- (4) The master's degree program Microbiology includes 45 ECTS CP for compulsory modules and 45 ECTS CP for elective modules. The master's degree program Molecular Cell Biology includes 42 ECTS CP for compulsory modules and 48 ECTS CP for elective modules. The master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) includes 30 ECTS CP for compulsory modules and 60 ECTS CP for elective modules. The master's degree program Plant Sciences includes 24 ECTS CP for compulsory modules and 66 ECTS CP for elective modules. All the degree programs include 30 ECTS CP for the master's thesis. Details on electives, compulsory modules, admission to courses and the amount of ECTS credit points per module are set forth in the module structures (Annexes 1 to 4).
- (5) Students receive a curriculum as a recommendation on how to structure their course of studies. Students may receive an individual study schedule upon request.
- (6) The language of instruction and examination for the master's degree programs Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology), Molecular Cell Biology, and Plant Sciences is English. The language of instruction and examination for the master's degree program Microbiology is either German or English, depending on the module. The examination board may make exceptions for individual elective modules and shall announce them before the beginning of the semester, pursuant to § 8, para. 7.
- (7) The degree program starts in the winter semester of each year.

Part 3

Admission requirements and recognition of academic achievements

§ 5

Degree program admission requirements

- (1) The consecutive master's degree programs Plant Sciences, Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology), Molecular Cell Biology and Microbiology are open to applications from graduates from a university undergraduate degree program in one of the life sciences or a related field. The master's degree program Microbiology requires a university undergraduate degree in biology, biochemistry, biotechnology, nutrition and food sciences, agricultural sciences, medicine or a related field.
- (2) The university degree in para. 1 must have been completed with a grade of at least 2.7 for the degree programs Plant Sciences, Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) and Molecular Cell Biology.
- (3) For the master's degree program Microbiology, the university degree in para. 1 must provide proof of the following qualifications:
Knowledge of microbiology at the level of a bachelor's in biology equivalent to 5 CP or equivalent proof.
For the master's degree program Molecular Cell Biology, the university degree in para. 1 must provide proof of the following qualifications:
Practical knowledge in biochemistry, molecular biology, microbiology and cell biology at the level of a bachelor's in biology equivalent to 5 CP each (total 20 CP) or equivalent proof.
For the master's degree programs Plant Sciences and Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology), the university degree in para. 1 must provide proof of the following qualifications:

Knowledge of practical laboratory work equivalent to 20 CP.

(4) Applicants to the master's degree program Microbiology must have knowledge of the German language at level C1 or higher according to the Common European Framework of Reference for Languages (CEFR); a university entrance qualification acquired in the German language from a German-language institution, a German language test (e.g. DSH 2, TestDaF at the level TDN 4), or equivalent qualification can be used as proof.

(5) English skills at level B2 or higher according to the Common European Framework of Reference for Languages (CEFR) are a prerequisite and are to be proved by submitting a recognized language certificate (e.g. TOEFL, IELTS) or equivalent proof. Notwithstanding this, English skills at level C1 or higher according to the Common European Framework of Reference for Languages (CEFR) are a prerequisite the master's degree programs Molecular Cell Biology and Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) and are to be proved by submitting a recognized language certificate (e.g. TOEFL, IELTS) or equivalent proof.

(6) Foreign applicants for the degree programs Molecular Cell Biology and Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) who are not given equivalent status to Germans by or based on international treaties must provide proof that they have passed the aptitude test for university studies in the degree program concerned in accordance with Annexes 6 and 7.

(7) This does not affect admission restrictions due to capacity limits (numerus clausus).

(8) Students who do not meet the admission requirements stated in para. 1–3, but have already taken all examinations necessary for graduating from an undergraduate degree program, may already enroll for a master's degree program if there is sufficient proof of their aptitude for that degree program, which is determined with special regard to the average grade for all examinations taken to that point. Enrollment is revoked with effect for the future if necessary proof of meeting the admission requirements is not submitted to the admission office within six months after the date of enrollment.

§ 6

Recognition of and granting credit for academic achievements

(1) Academic achievements in degree programs at other public or officially recognized universities, at public or officially recognized vocational academies, in degree programs at foreign public or officially recognized universities, or in another degree program at the University of Bonn will be recognized if the acquired skills are deemed equivalent to those that would have been acquired at the University of Bonn; an equivalency assessment is not performed. The examination board assigns credit points for these achievements to the corresponding modules defined in the curriculum. Enrollment may be denied to applicants who failed the final attempt at an examination that cannot be compensated for in a degree program with substantial similarities in content with the chosen master's degree program.

(2) The question of recognition shall be reviewed with special regard to the significance of differences. In order to determine whether significant differences do or do not exist, the topic, scope and requirements of the academic achievement to be recognized is compared to the same aspects of the academic achievement that the former is to replace. This shall not be done by schematic comparison but rather in the form of an overall review and evaluation. A difference in the amount of awarded ECTS credit points alone does not constitute significant difference. The aforementioned regulations apply analogously to academic achievements in degree programs designed for continued education. Academic achievements are recognized to their full extent if significant difference cannot be determined. If the reviewers, in accordance with the principles described above, find that a certain academic achievement can only be recognized in part, credit points shall partially be assigned to the respective module. The respective module shall only be considered passed when all missing coursework and/or examinations are completed; only then, ECTS credit points shall be awarded to the extent stipulated in these Regulations. Scope and nature of coursework and/or

examinations to be completed are at the discretion of the examination board. Equivalence agreements approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of the Federal Republic of Germany and the German Rectors' Conference as well as agreements under university partnerships shall be observed.

(3) In accordance with § 8, para. 4, sentence 2, the examination board has authority over the processes that underlie recognition of or granting credit for academic achievements. The examination board decides which degree programs are related to or show substantial similarities in content with the chosen degree program. Representatives of the relevant departments shall be consulted when reviewing the significance of differences. In case of doubts regarding whether academic achievements completed abroad should be recognized, the Central Office for Foreign Education may be consulted. Students shall be notified within eight weeks of whether an academic achievement is recognized, including information on legal remedies available. In case an achievement is not or only partially recognized, the examination board shall provide the reasons for its decision, thus bearing the burden of proof. If the examination board denies recognition, students may apply for an internal audit of the decision to be conducted by the Rectorate.

(4) If examinations are recognized, the same grades—provided grading systems are comparable—shall be added to the student's transcript of records and, weighted with the ECTS credit points of the module to which credit points are assigned, considered when calculating the overall grade. If coursework is recognized, the entry "pass" shall be made in the student's transcript, not assigning a grade. Should the grading systems not be comparable, the entry "pass" shall also be made in the student's transcript. Recognized academic achievements shall be identified as such in the student's certificate. Academic achievements in degree programs not using the ECTS credit point system shall be translated by the examination board into the ECTS credit point system, provided that the respective examination is equivalent to the module examinations defined in these Examination Regulations. Such translation must adhere to the scale approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of the Federal Republic of Germany for comparisons to the ECTS system.

(5) If the requirements defined in para. 1 are met, students are legally entitled to have their academic achievements recognized. The student must provide all information on the academic achievement in question deemed necessary for recognition. Each semester, the examination board defines a deadline in that semester by which applications for recognition must be submitted. Applications submitted after that deadline cannot be processed until the subsequent semester. After registration for a module examination, it is no longer possible to submit a request for recognition for this examination (cut-off date).

(6) Applicants who, due to their performance in a placement test as per § 49, para. 12 of the NRW Higher Education Act, have earned the right to enter the degree program in a higher program-related semester will be granted credit for the knowledge and skills demonstrated in the placement test, with credit points being assigned to examinations that form part of the master's examination. The examination board is bound to the results of the placement test stated in the certificate.

(7) Knowledge and qualifications acquired in a manner other than academic studies will not be recognized.

§ 7

Admission to individual courses

(1) If admission to a course, due to its nature, purpose or to other reasons, needs to be limited and the number of applications exceeds the defined capacity, the lecturer may file a request with the examination board of the degree program to which the respective module is assigned to manage admissions to that course, giving due regard to § 59 of the NRW Higher Education Act. Criteria for admissions in these cases are stipulated in Annex 5 of these Examination Regulations.

(2) The examination board shall define the maximum number of participants in courses with limited capacity. The examination board shall announce capacities at the beginning of each semester.

Part 4

Examination board and examiners

§ 8

Examination board and exam office

(1) The faculty council of the Faculty of Mathematics and Natural Sciences shall appoint an examination board for each of the master's degree programs Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) and Plant Sciences that are to organize examinations and perform the tasks assigned in these Examination Regulations. Similarly, the faculty councils of the Faculty of Mathematics and Natural Sciences, Faculty of Medicine and Faculty of Agriculture shall appoint a joint examination board for each of the master's degree programs Microbiology and Molecular Cell Biology. The dean of the Faculty of Mathematics and Natural Sciences shall ensure that the examination boards are able to duly fulfill their tasks and reliably do so. The dean shall give appropriate instructions and provide necessary administrative support.

- (2) Each examination board shall consist of seven voting members, including
- four members from the group of professors of the faculty or, in the case of a joint examination board, of the three faculties (including the chairperson and deputy chairperson);
 - one member from the group of academic staff of the faculty and
 - two members from the group of students of the faculty.

The chairperson, deputy chairperson and other members are appointed separately by group by the faculty council or in the case of a joint examination board by the three faculties. All professors who teach in one of the degree programs in para. 1 are eligible to become members of the corresponding examination board. The chairpersons of the joint examination boards for the master's degree programs Microbiology and Molecular Cell Biology come from the Faculty of Mathematics and Natural Sciences; each faculty should also appoint a representative from the group of professors to the examination board. From the group of academic staff, those who are teaching in the degree program concerned or are involved in the management of the degree program are eligible to become members. From the group of students, those enrolled in the degree program concerned are eligible to become members. For each of the seven members a deputy shall be appointed to represent the member in his or her absence; these deputy members may not assume the position of chairperson of the examination board. The term of office of members from the group of professors and from the group of academic staff is three years, and the term of office of the student members is one year. Members may be re-appointed.

(3) The examination board is an administrative body as defined by German administrative procedure law and the German law governing procedure in contentious administrative matters. The faculty shall create an office (Examination Office) for administrative support of the examination board.

(4) The examination board shall ensure compliance with the provisions of the Examination Regulations and make certain that the examination procedure is conducted in accordance with regulations. The examination board shall appoint examiners as well as assistant examiners and is responsible in particular for recognizing academic achievements as well as handling objections against decisions made within examination procedures. The examination board shall report to the faculty council on a regular, at least annual basis on the development of examination and study periods, including the time taken to complete master's theses and the distribution of overall grades. Once a semester, the examination board shall inform the Student Registry on which students, according to final ruling by the examination board, have failed their final attempt at passing the master's examination in accordance with § 24, para. 6 or do not meet the requirements to be admitted to the master's examination as per § 11, para. 1. The examination board shall provide input for amendments to the Examination Regulations and curriculum. It may delegate clearly defined tasks to the chairperson. It shall not delegate

- decisions on objections as per sentence 2,
- reviews of decisions on deception and disruption of examinations as per § 22, para. 1, sentences 1 and 2,

- assessments of whether a student repeatedly or otherwise seriously attempted to cheat as per § 22, para. 3,
- decisions on the invalidity of the master's examination and revocation of the master's degree as per § 29 and
- reporting duties to the faculty council as per sentence 3.

(5) Examination board meetings are not open to the public. All members of the examination board as well as their deputies shall be bound to confidentiality. Members who are not civil servants shall be bound to confidentiality by the chairperson of the examination board. Summary minutes shall be taken as record of the examination board's discussions and decisions.

(6) The examination board shall have a quorum when, in addition to the chairperson or their deputy, at least four more members or their deputies, including at least two members from the group of professors, are present. Resolutions shall be passed by simple majority. In the event of a tie vote, the chairperson's vote or, in case of his/her absence, the deputy chairperson's vote shall be the deciding vote. The examination board may adopt resolutions by means of a circulation procedure if none of the members objects. The examination board shall have a quorum for resolutions voted on using a circulation procedure if the chairperson of the examination board has received the number of member votes stipulated in sentence 1 by the deadline set for the circulation procedure; the resolution is otherwise not passed. Members of the examination board have a right to attend examinations upon resolution of the examination board.

(7) Directives, dates set and other communication of the examination board with public relevance shall, giving due consideration to data protection requirements, be made available by public display or in electronic form with legally binding effect. Other additional publications are permissible but not legally binding.

(8) The examination board may include examination office staff involved in the examination procedure for consultation on a regular basis or for individual meetings or agenda items. These staff shall have a right to speak but no right to vote.

§ 9

Examiners and assistant examiners

(1) The examiners and assistant examiners shall be appointed by the examination board. Examinations may only be held by persons teaching at the University of Bonn and, if necessary or appropriate with regard to fulfilling the purpose of the examination, people with practical and training experience in the field. Examinations may only be graded by persons with at least the same or an equivalent qualification as the one to be determined through that examination. Assistant examiners must have at least passed the master's examination or an equivalent examination.

(2) Module examinations are usually held by the responsible teaching staff on that module. If a teacher, due to illness or other important cause, is not able to hold module examinations in due time, the examination board shall be responsible for the appointment of another examiner for these module examinations. As a rule, these examiners should have already taught courses in the module concerned or a related module on their own authority.

(3) Examiners shall be independent of instructions in their conduct of examinations.

(4) Candidates may propose examiners for their master's thesis. A candidate's proposal should be followed whenever possible; however, it does not substantiate a claim.

(5) The examination board shall ensure that the candidate is informed of the names of the examiners in due time, as a rule at least two weeks before the date of the respective examination.

Part 5

Scope, conduct, modalities and forms of examinations

§ 10

Scope of the master's examination

- (1) The master's examination is intended as proof of qualification for positions demanding extensive skills in the respective field as well as in-depth and research-oriented scientific qualification.
- (2) The master's examination consists of
 1. module examinations completed during the course of studies and reflecting the contents and qualification targets of the modules specified in the applicable module structure (Annexes 1 to 4);
 2. proof that the requirements in the module structure for acquiring ECTS credit points instead of a module examination are satisfied;
 3. the master's thesis.

All examinations are to be completed within the standard period of study stipulated in § 4, para. 1.

- (3) Examinations are completed during the course of studies. As a rule, one module examination is assigned to each module, even when a module consists of more than one course. The grade of the module examination will be indicated on the degree certificate. Students must successfully complete a module in order to be awarded the assigned ECTS credit points. A module is considered successfully completed once
 - a. the assigned module examination or all of the assigned examination components of the module have been graded "sufficient" or higher.
 - b. proof has been provided that the requirements in the module structure for acquiring ECTS credit points instead of a module examination are satisfied.
- (4) If a module consists of more than one course, with associated module examination components, the ECTS credit points will be awarded after the last module examination component has been passed.
- (5) Examinations are generally held in the language of instruction. Upon request by the student and after consultation with the examiner(s), examinations or parts of examinations can also be taken in another language. However, no right to take parts of the examination in this language exists.

§ 11

Admission to the master's examination and to module examinations

- (1) The student must apply for admission to the master's examination. This application shall be submitted to the examination board in writing, at the latest with the registration for the first module examination. The application shall include the following documents as proof of meeting the admission requirements:
 1. Proof of meeting the general admission requirements stipulated in § 5;
 2. a certificate of enrollment as proof of enrollment as student in the chosen degree program at the University of Bonn;
 3. a statement whether the student has failed a final attempt at an examination or the final attempt at the master's examination in the chosen degree program or, at the time of registration for a module examination, is involved in another examination that, if failed, would give cause for denial of enrollment. The same applies to examination procedures of degree programs with substantial similarities in content.
- (2) The examination board may only admit students to module examinations who
 1. can provide proof of meeting the admission requirements as per para. 1;
 2. meet all requirements that may be stipulated in the applicable module structure (Annexes 1 to 4) for the module and module examination.

The proof specified in sentence 1, point 1 is not required for admission to module examinations if proof of enrollment as a student in another degree program at the University of Bonn is provided and that degree

program imports the respective module in accordance with its examination regulations, or proof of admission as a cross-registered student in accordance with § 52, para. 1 of the NRW Higher Education Act is provided.

(3) Should the candidate not be able to submit documented proof as per para. 1 sentence 3 in the required form, the examination board may allow the candidate to provide proof in another form.

(4) Admission to the master's examination procedure or, respectively, module examinations is at the discretion of the examination board.

(5) The examination board may only deny admission to the master's examination procedure where

- a. documents submitted are incomplete as per para. 1 and/or not submitted as requested by a certain deadline;
- b. the requirements specified in para. 1 are not met;
- c. the student has failed a final attempt at an examination that cannot be compensated for or failed the final attempt at the master's examination in this degree program or in a degree program with substantial similarities in content to the chosen degree program; or
- d. the student is registered for an examination procedure at another university in the chosen degree program or a degree program with substantial similarities in content as per § 6, para. 1, if failing the examination procedure would mean failing the final attempt at the master's examination.

(6) The examination board may only deny admission to a module examination where the criteria defined by para. 2 are not met.

§ 12

Examination modalities and compulsory attendance

(1) Module examinations cover the contents and qualification targets of the modules specified in the applicable module structure (Annexes 1 to 4).

(2) Candidates in module examinations must be students enrolled in the chosen degree program at the University of Bonn or, respectively, in a degree program at the University of Bonn of which modules are imported in accordance with the Examination Regulations, or admitted as cross-registered students as defined by § 52, para. 1 of the NRW Higher Education Act.

(3) In the module examinations, students are to demonstrate the knowledge and competences acquired in the respective module as well as their ability to understand cross-disciplinary correlations. Module examinations can be completed by passing graded examination components. Module examinations and module examination components can be

- written examinations;
- oral examinations;
- term papers;
- project reports;
- presentations;
- seminar talks;
- research proposals;
- quizzes;
- posters and
- reports.

The type of examination and, if applicable, division into module examination components is stipulated in the applicable module structure. Deviating from the specifications stipulated in the module structure is possible in accordance with § 15, para. 4, § 16, para. 4 and § 17, para. 9; the examination board shall, in conjunction with the examiners, determine the type of examination and, in accordance with § 8, para. 7, announce its decision in due time before the beginning of the semester.

(4) The module structure may stipulate that students must have completed certain assessments (coursework) prior to taking a module examination. Where required coursework has not been completed, students shall not be admitted to the module examination. Upon request filed by the lecturer, the examination board shall announce the specific requirements regarding such coursework before the beginning of the semester pursuant to § 8, para. 7.

(5) Two examination dates shall be set for all written and oral module examinations. As a rule, the first examination date shall be set shortly after the end of the courses in the module. The second examination date shall be set in a manner that the degree program can be properly continued and completed within the standard period of study. The examination board shall, in accordance with § 8, para. 7, announce all examination dates as well as the duration of individual examinations before the beginning of the semester. Candidates who only take the examination at one of the two examination dates and do not pass the examination are not entitled to another examination date during the current semester.

(6) For courses in which achieving the qualification target requires active participation by students, the module structure may stipulate mandatory regular participation (compulsory attendance) as prerequisite to being admitted to the examination. Before the beginning of the semester, the examination board shall give reasons for its decision on which courses require compulsory attendance. In such cases, the examination board shall also define when participation can be considered regular. Depending on the qualification target, absences of up to 10% are permissible if a medical certificate is provided. Exceptions shall be decided by the examination board. The examination board shall announce the decisions in sentences 2 to 4 before the beginning of the semester pursuant to § 8, para. 7.

(7) The following applies when grading examinations:

1. Examinations submitted in writing shall be graded by a minimum of one examiner. Candidates shall be informed of the result of such examinations within four weeks. In accordance with the applicable data protection regulations, results shall be made available by public display or in electronic form via the examination management system; as a rule, results are to be made available before the standard period of study ends.
2. Oral examinations shall always be graded by a minimum of two examiners or by a single examiner in the presence of a competent assistant examiner. A record shall be kept of the essential topics and results of each examination. If the examination is conducted by a single examiner in the presence of an assistant examiner, the examiner shall hear the assistant examiner in private prior to setting a grade. Candidates shall be informed of their grade immediately following the oral examination.

If the examination is conducted by two examiners, the grade shall be calculated using the average of the two individual grades. Examinations to be completed in the course of studies that cannot be compensated for once the final attempt has been failed shall always be graded by a minimum of two examiners; if the grade of only one examiner would result in a written examination being deemed failed, a third examiner shall be appointed. In this case, the two best grades shall be averaged together for the final grade.

(8) The examination board can permit module examinations to be taken in electronic form or using electronic communications. The examination board shall determine the details for conducting these examinations.

§ 13

Module examinations—registration and withdrawal

(1) For each module examination, students shall electronically register with the examination board by the prescribed deadline. Where justified, registrations may be submitted in writing.

(2) The examination board shall make the examination dates as well as registration periods available by public display or in electronic form; registration periods are cutoff periods.

(3) Candidates may withdraw from a written or oral examination electronically without indicating reasons until one week before the examination date. This shall not affect para. 6. Candidates may withdraw from term papers and project reports until one week before assignment of the topic. The date of receipt by the examination board determines whether the deadline has been met. In cases of examinations that spread over a whole semester or are assigned to a specific course, candidates may not withdraw without giving reasons once topics or places have been assigned. Notwithstanding sentence 4, the examination board can set extended withdrawal deadlines for seminar talks, presentations and reports for field and lab exercises. The examination board announces the separate deadlines by public display or electronically.

(4) Rules for registration for the master's thesis are defined separately in § 19, para. 2.

(5) Students must register for their first attempt at an examination in compulsory modules (except for the master's thesis) by the end of the third semester after the semester in which the course to which the examination is assigned in the applicable module structure/curriculum was planned. Students who fail to register within this period lose their right to examination unless they can prove that they were not at fault for failing to register in a timely manner. If the module structure specifies two different semesters in which the course can be taken, the later semester determines the beginning of the period specified in sentence 1. Students who lose their right to examination are deregistered from the degree program by the Student Registry once the examination board's decision has come into force.

(6) In the consecutive master's degree programs Microbiology and Molecular Biology, students who fail a module examination shall automatically be registered for the second following examination date, from which they may no longer withdraw without giving reasons. Automatic registration does not occur in the consecutive master's degree programs Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) and Plant Sciences.

§ 14

Resitting examinations

(1) Examinations that have been graded "insufficient" may only be repeated twice. Resits shall be conducted in accordance with § 13, para. 6. Rules for repetition of the master's thesis are defined in § 20, para. 7.

(2) Students who fail the same compulsory module three times lose their right to examination and are deregistered from the degree program by the Student Registry once the examination board's decision that the final attempt at the master's examination has been failed has come into force.

(3) Students who fail the same elective module three times lose their right to examination in that module. If the final attempt at an elective module has been failed, the student can choose another, previously unchosen elective module as compensation. Such compensation is only possible twice. Students who fail their final attempts to pass three elective modules shall lose their right to examination and are deregistered from the degree program by the Student Registry once the examination board's decision that the final attempt at the master's examination has been failed has come into force.

(4) Module examinations graded "sufficient" or higher cannot be repeated. Notwithstanding sentence 1, students in the degree programs Microbiology and Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) who have acquired at least 45 credit points may, upon request, repeat passed examinations in up to two compulsory modules once in order to improve their grades, provided their master's thesis has not yet been submitted. The better of the two grades obtained shall apply. Repeating passed examinations is not possible otherwise.

(5) Should a student fail to attend a compulsory resit examination without valid excuse, that examination will be graded "insufficient".

(6) In modules in which examinations spread over a whole semester or are assigned to a specific course, examinations cannot be repeated in that same semester. The module examination in such modules can only be repeated by retaking the entire module or course. Respective examinations and coursework to be repeated are designated as such in the applicable module structure.

§ 15

Written examinations

(1) In written examinations, students are to demonstrate that, within a specific period of time and with limited auxiliary means, they are capable of understanding a problem from the module's subject area and solving this problem using methods commonly used in that field. The examiners shall announce in a timely manner which auxiliary means may be used during a written examination.

(2) Written examinations may be handwritten or computer-aided examinations, both conducted under supervision. Computer-aided written examinations are in particular free text or clozes that are completed using a computer.

(3) Written examinations shall last a minimum of 30 minutes and a maximum of 180 minutes. § 12, para. 7 applies accordingly. The examination board shall announce the specific examination date before the start of the semester, in accordance with § 8, para. 7.

(4) The examination board may, in conjunction with the examiner, decide that instead of a specified written examination, an oral examination shall be held that covers the module's subject area; in accordance with § 8, para. 7 this shall be announced in due time before the beginning of the semester.

§ 16

Oral examinations

(1) In oral examinations, candidates are to demonstrate sound knowledge in the subject of examination, identify correlations and analyze specific questions arising from these as well as provide possible solutions.

(2) Oral examinations shall be conducted by either a panel of several examiners (*Kollegialprüfung*) or a single examiner in the presence of a competent assistant examiner, with candidates being examined either individually or in a group. If the examination is conducted by a panel of several examiners, the candidate shall be examined by one examiner per subject of examination. This shall not affect the provisions set forth in § 12, para. 7. Each oral module examination shall last a minimum of 15 minutes and a maximum of 45 minutes per candidate. When candidates are examined in a group, each candidate within that group shall be examined for the same amount of time.

(3) Students who wish to take the same oral examination at a later date may be admitted to sit in on the examination, provided that spatial circumstances allow for it and no candidate objects to their presence. The decision shall be made by the examiner, and in the case of examinations conducted by a panel of several examiners (*Kollegialprüfung*), by the examiners. Students sitting in on an examination shall attend neither the discussion nor the announcement of results. They shall also be prohibited from taking notes during the examination.

(4) The examination board may, in conjunction with the examiner, decide that, instead of an oral examination, a written examination shall be held that covers the module's subject area. This shall be announced in due time before the beginning of the semester pursuant to § 8, para. 7.

§ 17

Term papers, project reports, presentations, seminar talks, research proposals, quizzes, posters and reports

- (1) For term papers, candidates are to demonstrate that they are able to perform independent research on a limited topic in one of the subject areas of the module using methods commonly used in that field and to present this in writing in a manner that satisfies scientific requirements. Each term paper shall contain a minimum of 5 and a maximum of 30 DIN A4 pages. Candidates shall have a minimum of one and a maximum of fifteen weeks to prepare a term paper after receiving the topic. As a rule, registration for a term paper, including topic specification, takes place in the semester in which the associated course is offered. The topic of the term paper must be issued in timely fashion, so that—depending on the semester of the examination registration—the latest deadline, as a rule, is March 31 in a winter semester and September 30 in a summer semester. Term papers are generally graded by two examiners.
- (2) As a rule, project reports are used to show an ability to work in a team and, in particular, the ability to develop, implement and present concepts. Candidates are to demonstrate that they can define objectives and develop cross-disciplinary problem-solving approaches and concepts for a complex assignment. Candidates shall have up to six weeks to prepare a project report after receiving the topic. In the case of group project reports, it must be possible to clearly identify and grade the contribution of each individual candidate, and the contribution must satisfy the requirements in sentence 1. The presentation should be a minimum of 10 and a maximum of 30 minutes long for each candidate. As a rule, project reports must be completed by the end of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).
- (3) Presentations are oral presentations that last a minimum of 10 minutes and a maximum of 45 minutes. Candidates demonstrate their ability to comprehensibly present and discuss their own documented research results obtained using scientific methods. Candidates shall have a minimum of two weeks to prepare a presentation after receiving the topic. Presentations must be held by the end of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).
- (4) Seminar talks are oral presentations that last a minimum of 10 minutes and a maximum of 45 minutes and are based on original scientific texts. In seminar talks, candidates demonstrate their ability to comprehensibly present research results and explain them in a discussion. As a rule, seminar talks are supplemented by a hand-out as defined in para. 5 letter d. Candidates shall have a minimum of 2 weeks to prepare an oral presentation after receiving the topic. The oral presentation for a seminar talk must, as a rule, be held during the course of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).
- (5) Research proposals are common research documents in Anglo-American academic routine; they are between 0.5 (at least 200 words) and 5 DIN A4 pages in length and candidates have between 2 days and 2 weeks to prepare them:
 - a. Data sheets are research documents prepared independently by the candidate that are a maximum of two DIN A4 pages in length in which candidates formally present the results of scientific research and/or their own research relating to a biological species or a process. Data sheets have a precise layout that is given out at the beginning of the course and are aimed at creating a common pool of knowledge in a course. Candidates shall have a maximum of one week and a minimum of two days to prepare them.
 - b. Written graded projects are research documents prepared on a specified topic that are a maximum of 5 DIN A4 pages in length and based on original scientific texts. Written graded projects document the candidate's ability to prepare a research text as a short manuscript with an abstract, citations and figures that is correct in terms of form and content. Candidates shall have 2 weeks to prepare a written graded project after receiving the topic.

- c. Abstracts are written summaries of a research text or presentation that are a maximum of 1 DIN A4 page (400 words) in length. Abstracts document the candidate's ability to summarize a long research text or presentation as an abstract that is correct in terms of form and content. Candidates shall have a maximum of one week to prepare them.
- d. Hand-outs are a written summary that is 1 DIN A4 page in length, can also include graphical components and presents the key statements in a seminar talk that is based on original scientific texts.
- e. Methodology worksheets are written documents on a methodological or epistemological matter, e.g. hypothesis-driven research or plagiarism, that are a maximum of 3 DIN A4 pages in length. Methodology worksheets document the candidate's basic understanding of theoretical research relationships. Candidates shall have a maximum of one week to prepare them.

(6) Quizzes are examinations that are a maximum of 15 minutes long and are aimed at checking knowledge of content that was previously learned, or the ability to transfer that knowledge to answer questions in other areas. A quiz shall consist of one knowledge-transfer test or up to 10 questions. The time provided to complete the quiz must be in proportion to the complexity of the test or questions.

(7) Posters are one-page graphical representations of an independent research project that candidates present to the examiners in a five-minute poster presentation. The poster presentation is followed by a question period lasting a maximum of five minutes. The poster and poster presentation are graded based on criteria specified at the beginning of the course and are aimed at informing the entire group about the results of individual projects. Candidates shall have a maximum of one week and a minimum of 2 days to prepare them.

(8) Reports are written summaries of individual scientific research, field trips or field exercises in which candidates comprehensibly present the sequence and results of their work, field trips or field exercises. Reports are based on notes, original scientific texts and individual research. Their layout, structure and scope (5–30 DIN A4 pages) shall reflect that of scientific publications. Candidates shall have a minimum of two weeks to prepare a report after receiving the topic of the scientific research, field trip or field exercise.

(9) The examination board can, with the agreement of the examiners, make the following changes to the type of examination covering the subject area of the module:

- a. Term papers and seminar talks are interchangeable.
- b. Reports, presentations and posters are interchangeable.
- c. Written examinations and reports are interchangeable.

In accordance with § 8, para. 7, the change in the type of examination shall be announced in due time at the beginning of the semester.

(10) Otherwise, the provisions for grading oral and written examinations stipulated in § 12, para. 7 apply accordingly.

§ 18

Accessibility accommodations and deadline extension

(1) Students who are unable to take an examination in the designated manner due to a disability or chronic illness, or due to maternity law provisions, can submit a request for accessibility accommodations to the examination board together with suitable proof; the same shall apply to the completion of coursework as specified in § 12, para. 4. Accessibility accommodations shall be granted on a case-by-case basis in accordance with § 64, para. 3a of the NRW Higher Education Act. They can, in particular, provide for differences with respect to how the examination is taken, the length of the examination and the use of auxiliary means or support persons. For students with disabilities or chronic illnesses, the entitlement to accessibility accommodations shall extend to all of the examinations to be taken during the degree program, provided no change is expected in the illness or disability; sentence 2 remains unaffected. In the case of compulsory attendance courses and compulsory lab courses, internships and study periods abroad that

cannot be completed due to the impairment, even with the support of the university, alternative forms of assessment that can provide equivalent competence and qualifications shall be permitted.

(2) When determining the deadline for the first attempt at an examination in accordance with § 13, para. 5, the examination board shall, upon application and provision of respective proof, consider additional time for:

- a. Caring for and raising underage children as per § 25, para. 5 of the Federal Training Assistance Act (BAföG)—for a maximum of three semesters per child;
- b. Acting as elected representative in a university body, the student body, the student body's student councils or the Studierendenwerk—for a maximum of four semesters;
- c. Acting as gender equality officer—for a maximum of four semesters;
- d. Effects of a disability or severe illness prolonging the period of study;
- e. Caring for spouses, registered partners, direct relatives, second-degree indirect relatives or first-degree in-laws—for a maximum of three semesters.

Part 6 Master's thesis

§ 19

Registration, topic and scope of the master's thesis

(1) The master's thesis is an examination in the form of a written assignment in which candidates are to demonstrate their ability to conduct research on, develop a solution for and appropriately present a problem from their chosen master's degree program within a specified period of time, on their own authority and using scientific methods.

(2) Students must register their master's thesis with the examination board. The examination board shall announce the deadline by which a master's thesis must be registered for the candidate to complete the master's degree program within the standard period of study.

(3) When registering their master's thesis, students must indicate their choice of examiner for the master's thesis.

(4) Any examiner may assign the topic for the master's thesis in accordance with § 9, para. 1, sentence 1. As a rule, the examiner who assigned the topic also acts as supervisor of the master's thesis. Permission from the examination board shall be required when an external university professor who is active in research and teaching is to assign the topic for and supervise the master's thesis or when the candidate is to complete their thesis at a facility outside the University, which shall only be granted if appropriate supervision by an examiner can be assured.

(5) The topic for the master's thesis shall only be issued when the candidate meets all requirements for the master's thesis as stipulated in the module structure (Annexes 1 to 4). The examination board shall issue the topic for the master's thesis. A record shall be kept of the topic and the date of issue. Prior to registration of the master's thesis, students shall be given the opportunity to submit proposals for the research area from which the topic of their master's thesis shall be taken; they shall not, however, have the right to a topic from a specific area. Upon request by the student, the examination board shall ensure that the student receives a topic for his/her master's thesis in due time as per para. 9.

(6) Candidates may reject a master's thesis topic only once and only within the first two months after its issue. Rejecting a topic does not count as a failed attempt. The new topic issued to the candidate must be substantially different from the initial topic.

(7) The master's thesis cannot be approved in the form of a group thesis.

- (8) The master's thesis shall contain a minimum of 40 and a maximum of 80 DIN A4 pages of text.
- (9) Passing the master's thesis awards 30 ECTS CP, corresponding to 900 hours in student workload. It must be completed within a maximum of six months. The examination board shall determine the deadline by which the master's thesis must be submitted and notify the student of that deadline. Topic, task and scope of the master's thesis shall be limited in a way that candidates may complete it under reasonable requirements within the specified period. Upon valid request and in conjunction with the supervisor, the examination board may grant an extension by a maximum of six weeks. As a rule, the topic of the master's thesis is issued at the end of the third semester.

§ 20

Submission, evaluation and repetition of the master's thesis

- (1) Candidates shall submit four copies of their master's thesis to the examination board (in both print and a digital format suitable for electronic evaluation); a record shall be made of the time and date of submission. Candidates may not withdraw an already submitted master's thesis. Master's theses that are not submitted by the stated deadline shall be graded "insufficient."
- (2) Candidates shall declare in writing when submitting their master's thesis that the thesis is their own work, that they used only those sources and resources cited in the thesis and that they have marked citations as such.
- (3) Master's theses shall be evaluated and graded by two examiners. One of the examiners shall be the person who assigned the topic of the master's thesis; the second examiner shall be appointed by the examination board from among the group of examiners as defined by § 9, para. 1. It must be ensured that at least one of the examiners is a member of the group of professors (*Hochschullehrer*innen*) or adjunct professors (*Privatdozent*in*) at the University of Bonn. The candidate shall be entitled to propose examiners but shall not have a right to be assigned a specific examiner.
- (4) The examiners shall each provide a grade separately and provide the reasons for the grade they assigned in writing in accordance with § 24, para. 1. When the difference between the two grades is less than 2.0, they shall be averaged together for the final grade for the master's thesis. When the difference is 2.0 or more or one of the grades is "insufficient", the examination board shall appoint a third examiner for review of the master's thesis. In this case, the two best grades shall be averaged together for the final grade. Grades shall be averaged in accordance with § 24, para. 2. A master's thesis may, however, only be awarded the grade "sufficient" or higher when at least two of the individual grades were "sufficient" or higher.
- (5) Examiners shall submit their reviews of the master's thesis within eight weeks after the submission deadline.
- (6) Candidates who receive a grade of "sufficient" or higher for their master's thesis are awarded 30 ECTS CP.
- (7) Master's theses graded "insufficient" may be repeated once. The topic of the second master's thesis may be chosen from the same area as the topic of the first master's thesis but must be substantially different in nature. The candidate may reject the proposed topic for their master's thesis within the period specified in § 19, para. 6 only if they did not make use of this option with their first master's thesis. Should the second thesis also be graded "insufficient," the candidate shall have failed their final attempt at the master's examination, losing their right to examination and being deregistered from the degree program by the Student Registry once the examination board's decision has come into force.

Part 7

Procedural irregularities and protective regulations

§ 21

Cancellation, failure to appear, withdrawal and reprimand

- (1) Candidates may electronically cancel their registration for module examinations with the examination board before the deadlines indicated in § 13, para. 3; if this is not possible, cancellation can also be submitted in writing. The date of receipt by the examination board determines whether the deadline has been met.
- (2) If a candidate withdraws from an examination after the cancellation deadline without good cause, the examination is graded "insufficient." The same applies when a candidate fails to appear for an examination or to submit an assignment within the specified period of time (failure to appear).
- (3) Candidates who have registered for an examination but have good cause to withdraw from that examination, especially due to illness, may do so regardless of the cancellation deadline. The examination board shall be notified of such withdrawals immediately and in writing. Candidates shall immediately provide a written statement credibly substantiating the grounds for their withdrawal or failure to appear. In cases of illness, candidates shall present a medical certificate proving their inability to participate in the examination. Candidates who withdraw from an examination due to illness after the start of the examination and assignment of the respective task must consult a medical examiner that same day of the examination to obtain a certificate proving their inability to continue the examination. As a rule, it is not possible to withdraw from an examination after the start of the examination, especially when the candidate has already seen, or otherwise obtained knowledge of, the examination result. The examination board may, in individual cases, require the submission of a certificate from a medical examiner designated by the University if there are sufficient factual indications that the candidate would in fact have been able to participate in the examination or, respectively, submit their assignment on time or if the examination board deems other proof than that defined by sentence 4 appropriate in that case. If the examination board accepts a medical certificate allowing for withdrawal due to illness or other good cause given by the candidate, the examination attempt shall be deemed void.
- (4) Candidates shall immediately reprimand any deficiencies related to an examination with the respective examiner or proctor. The reprimand shall be entered into the record and asserted in front of the examination board. If the examination board accepts the reprimand, the examination attempt shall be deemed void.

§ 22

Deception and disruption of examinations

- (1) Candidates who try to influence the outcome of an examination through deception or the use of inadmissible auxiliary means shall receive the grade "insufficient"; the respective examiner or proctor shall identify deception or use of inadmissible auxiliary means, include it in the record and notify the examination board. The respective examiner or proctor may bar any candidate from continuing an examination who, despite a warning, disrupts the orderly conduct of the examination; in such cases, the examination shall be graded "insufficient." A record shall be made of the reasons for barring the candidate from the examination.
- (2) Candidates may, within a period of two weeks, request that decisions taken pursuant to para. 1, sentences 1 and 2 be reviewed by the examination board.
- (3) In cases of repeated or otherwise grave attempts at deception, the candidate may be deregistered from the degree program. The examination board shall determine whether the candidate's attempt at deception was repeated or otherwise grave. Deregistration of students due to deception is at the Rector's discretion. Deregistration is carried out by the Student Registry.

(4) Violation of the provisions in these Examination Regulations regarding deception in examinations is an administrative offense. This administrative offense may be subject to a fine of up to EUR 50,000. As competent administrative authority, the Provost of the University of Bonn shall pursue and fine administrative offenses pursuant to sentence 1.

§ 23

Protective regulations

(1) Regulations on maternity leave stipulated in the Maternity Protection Act (MuSchG) as amended shall be respected; students shall provide all necessary proof. All time frames stipulated in these Examination Regulations shall be suspended by maternity leave; time frames for periods of assessment shall not include periods of maternity leave. The examination board shall notify the student of newly determined examination deadlines once all necessary proof has been submitted.

(2) Allowances shall likewise be made on application for parental leave under the Parental Allowance and Parental Leave Act (BEEG) as amended. Candidates shall notify the examination board in writing of the period(s) during which they wish to take parental leave, enclosing necessary substantiating documentation, at least four weeks prior to the date on which they wish to enter parental leave. The examination board shall determine whether the statutory requirements have been met which would lead to an employee being entitled to parental leave under the BEEG and shall inform the candidate immediately of its findings and, if applicable, any new examination deadlines. Time frames for the completion of assignments may not be interrupted by a period of parental leave. The assignment topics shall be deemed not issued. The candidate shall receive a new topic at the end of their parental leave. This does not affect § 21, para. 3, sentence 1.

(3) Allowances shall likewise be made on application for leave taken for the care of spouses, registered partners, direct relatives, second-degree indirect relatives or first-degree in-laws who are in need of care. The examination board shall review whether the requirements defined by sentence 1 are met. The application is to be submitted as soon as these requirements are met. Relevant documentation shall be attached to the application. The examination board shall immediately notify the candidate of the result and, if applicable, of the new examination deadlines. Time frames for the completion of assignments may not be extended based on such leave taken. The assignment topics shall be deemed not issued. The candidate shall receive a new topic at the end of their leave. This does not affect § 21, para. 3, sentence 1.

Part 8

Grading and final documentation

§ 24

Grading of examinations, grading system and pass requirements for the master's examination

(1) The grade for each examination shall be determined by the respective examiners. If the examination is conducted by more than one examiner, the grade shall be calculated using the average of the individual grades. This does not affect § 12, para. 7. The following grading system shall be used:

1	very good	Excellent achievement
2	good	Achievement well above average requirements
3	satisfactory	Achievement corresponding to average requirements
4	sufficient	Achievement that still meets necessary requirements despite deficiencies
5	insufficient	Achievement that does not satisfy requirements due to substantial deficiencies.

In order to produce a graduated grading scale and provide a more nuanced evaluation, individual grades may be raised or lowered by values of 0.3; grades 0.7, 4.3, 4.7 and 5.3 shall not be admissible. An examination is passed if it is graded "sufficient" or higher; otherwise it is failed.

- (2) Only the first decimal place after the decimal shall be used when calculating the grades for individual modules or for overall performance; all further decimal places shall be dropped without rounding off.
- (3) A module examination shall be deemed passed when the module is graded at least “sufficient.” If a module grade includes more than one examination component, it shall be calculated using the individual examination weights indicated in the module structure. This does not affect § 10, para. 3, sentence 4. The grading scale for modules is:
- | | |
|--|----------------|
| With an average grade up to and including 1.5 | = very good |
| With an average grade from 1.6 up to and including 2.5 | = good |
| With an average grade from 2.6 up to and including 3.5 | = satisfactory |
| With an average grade from 3.6 up to and including 4.0 | = sufficient |
| With an average of 4.1 or higher | = insufficient |
- (4) Candidates shall have passed the master’s examination when they have passed all necessary modules as per § 4, para. 4 as well as the master's thesis and have thus been awarded a total of 120 ECTS CP.
- (5) The calculation of the overall grade shall include all graded modules. Each grade from individual modules shall be weighted by multiplying it with the number of ECTS credit points assigned to the respective module. The sum of these individually weighted grades is then divided by the total number of ECTS credit points (weighted average). Para. 3, sentence 4 applies accordingly. Deviating from this, the overall grade shall be “excellent” if the overall grade is no lower than 1.3 and the master’s thesis has been graded “very good” (1.0). Modules marked “passed” due to lack of comparability between grading systems shall not be included when calculating the overall grade.
- (6) The final attempt at the master’s examination shall be deemed failed when
- the candidate has three times failed to pass a module examination in a compulsory module as defined by § 10, para. 3, sentence 4, letter a or, respectively, § 14, para. 2;
 - the candidate has, pursuant to § 14, para. 3, lost their right to examination in three elective modules; or
 - the master’s thesis has been graded “insufficient” in the second attempt.

§ 25 Certificate

- (1) The candidate shall, upon request, be notified of the results of their successful master’s examination in a provisional certificate as soon as all grades have been submitted. A certificate shall thereafter be issued in German. Candidates may also receive an English translation of their certificate on application. The certificate shall include the following information:
- All modules for which ECTS credit points were earned;
 - The semester in which ECTS credit points were earned;
 - All grades from individual modules;
 - The topic and grade of the master’s thesis;
 - The date of the last examination and
 - The overall grade of the master’s examination.
- On application by the candidate, results from additional examinations as per § 30 may also be included in the certificate; these shall not be included when calculating the overall grade.
- (2) The certificate shall state the date of issue. The certificate shall be stamped with the seal of the Faculty of Mathematics and Natural Sciences and signed by the chairperson of the examination board.
- (3) Candidates who have failed their final attempt at the master’s examination shall be issued a written notification thereof by the examination board, including information on legal remedies available.

(4) Candidates who leave the university without a degree shall, up to two years after deregistration and on application, be issued a transcript including a list of all completed coursework and examinations. This transcript shall be limited to those parts of the student's chosen course of study which were successfully completed. In addition, a notification may be issued on application that indicates which examinations the student did not pass or still needs to complete in order to pass the master's examination.

§ 26

Master's diploma

Along with the certificate for the master's examination, candidates shall receive a master's diploma issued the same day in German stating that the candidate has been awarded the academic degree as per § 3. Instead of the German diploma, a master's diploma in German and English can be issued upon request. The request must be included when the master's thesis is submitted. Master's diplomas shall be signed by the dean of the Faculty of Mathematics and Natural Sciences of the University of Bonn and by the chairperson of the examination board as well as stamped with the seal of the Faculty.

§ 27

Diploma supplement

The master's diploma shall be augmented by a diploma supplement. The diploma supplement is a standard document in English and German that shall include the following information:

- Essential contents of the program underlying the degree;
- The course of studies;
- The competences acquired with the degree;
- Information on the accreditation of the chosen degree program and
- Information on the university awarding the degree.

The diploma supplement shall give a relative classification of the overall grade of the master's examination on the ECTS grading scale.

§ 28

Access to examination records

(1) Candidates shall, on application, be granted access to their examinations, the examiners' written reviews as well as records of oral examinations; applications must be submitted within three months after notification of the examination result. This does not affect § 29 of the Administrative Procedure Act (*Verwaltungsverfahrensgesetz*).

(2) Candidates shall, on written application within three months after the examination board has issued the certificate as per § 25, be granted access to their examination records. This does not affect § 29 of the Administrative Procedure Act (*Verwaltungsverfahrensgesetz*).

(3) The examination board shall determine when and where the examination records may be accessed and notify the candidate hereof in due time. The examination board shall determine the details concerning the possibility of preparing copies or other true reproductions, and shall announce them pursuant to § 8, para. 7. Copies and other reproductions of examination records or parts thereof are only intended for candidates to pursue their own rights arising under the legal examination relationship and are therefore only to be used by the candidates, or made available to persons engaged by the candidates to safeguard their legal interests. Any other duplication or distribution of copies or other reproductions is not permitted.

§ 29

Invalidity of the master's examination and revocation of the master's degree

(1) Should it become known after the certificate has been issued that the candidate used deception in an examination or their master's thesis, the examination board may correspondingly correct the grades for

those examinations or the thesis in which the candidate used deception as well as the overall grade and declare the entire master's examination or parts thereof failed.

(2) Should it become known after the certificate has been issued that the candidate had not met the requirements for admission to the master's examination, and should this have happened without any fraudulent intent on the part of the candidate, this defect shall be remedied by the candidate's successful completion of the examination. Should the candidate have wrongfully secured admission with intent, the examination board shall decide on the legal consequences in accordance with the Administrative Procedure Act.

(3) Candidates shall be heard before the examination board makes a decision.

(4) The incorrect certificate shall be withdrawn and, where applicable, a new certificate shall be issued. If one or more examinations are declared failed due to deception, the incorrect certificate also makes the master's diploma and all other graduation documentation void. Decisions pursuant to para. 1 and para. 2, sentence 2 may be taken only for a period of five years after the issue of the certificate.

(5) Should the master's examination be deemed altogether failed, the master's degree shall be revoked and the master's certificate, master's diploma as well as all other graduation documentation shall be withdrawn.

§ 30

Additional examinations

Students may, until the end of the semester in which they complete the master examination as per § 10, para. 2, extend their standard scope of studies on application by up to 20 ECTS CP in additional modules. These may be modules from the chosen master's degree program as well as other modules for which credit would otherwise not be granted, provided that they are offered at the University of Bonn and eligible as additional module for the chosen degree program. Credit can only be granted for modules that are completed within one and a half times the standard period of study. The results of additional examinations shall be included in the certificate in accordance with § 25 on application by the candidate, however it shall not be included when calculating the overall grade.

Part 9
Entry into force

§ 31
Entry into force and publication

- (1) This Amendment and Reannouncement shall enter into force on October 1, 2020.
- (2) Under § 12, para. 5 of the NRW Higher Education Act, violations of the procedural or formal requirements of the Higher Education Act or regulatory or other legal provisions of the University of Bonn may no longer be asserted against these Regulations if one year has passed since their announcement.

J. Beck

The Dean
of the Faculty of Mathematics and Natural Sciences
of the University of Bonn
Professor Dr. Johannes Beck

Executed pursuant to the resolution adopted by the faculty council of the Faculty of Mathematics and Natural Sciences on January 20, 2021, the resolution adopted by the faculty council of the Faculty of Agriculture on January 20, 2021, the resolution adopted by the faculty council of the Faculty of Medicine on January 11, 2021 and the resolution passed by the Rectorate on February 23, 2021.

Bonn, March 17, 2021

M. Hoch

The Rector
of the University of Bonn
Professor Dr. Dr. h.c. Michael Hoch

Annex 1: Module structure for the consecutive master's degree program Microbiology

Module structure key:

- Abbreviations of course types: FT = field trip, C = colloquium, P = practical lab work/internship, S = seminar, E = exercise, V = lecture.
- Marked with asterisk (*): Courses for which the examination board may, pursuant to § 12, para. 6, require compulsory attendance as prerequisite for participation in the module examination (field trips, lab courses and practical work, as well as comparable courses). In these cases, compulsory attendance is an additional requirement to the other coursework listed.
- The "Course Type" column shows the type of a course within the module.
- The "Duration/Program-Related Semester" column shows the duration (D) of the module (in semesters) and assigns it to a specific program-related semester (PRS).
- The "Coursework" column shows requirements that must be met for admission to certain examinations pursuant to § 12, para. 4 or, respectively, to acquire ECTS credit points in modules without an examination. Coursework that is required for admission to certain examinations and must be repeated in case that examination is failed is marked with the letter "r" (r).
- In the "Type of Examination" column, examinations as defined by § 14, para. 6 that cannot be repeated within one semester but must rather be repeated along with the entire module or, respectively, the corresponding course are marked with the letter "r" (r).

The examination board shall make further details on individual modules, especially regarding the courses offered within or required for completion of a module, available in a module guide before the beginning of the respective semester pursuant to § 8, para. 7.

Compulsory Modules

Module Code	Module Name	Course Type	Admission Requirements	Duration/Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB1	General and Molecular Microbiology and its Methods Theory Module	L, E*	None	D: 1 sem. PRS: 1 st sem.	Detailed theoretical knowledge in general and molecular microbiology	None	Written examination	6
MIB2	General and Molecular Microbiology Lab	L, P*	None	D: 1 sem. PRS: 1 st sem.	Students are familiarized with the principles of general and molecular microbiology. They also acquire a sound knowledge of spectroscopic and spectrometric analytics, genetic techniques, plasmids, expression and the specific physiological characteristics, regulatory mechanisms and DNA transfer of the major prokaryotes.	Report	Written examination	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB3	Medical Microbiology (bacteriology, parasitology, immunology)	L, P*, S*	None	D: 1 sem. PRS: 1 st sem.	Upon completing the course, students will have learned the basics of medical bacteriology, parasitology and immunology. They study normal human flora, pathogenic bacteria and parasites that produce infectious diseases, their diagnosis in a clinical laboratory and the interaction between host and pathogen. Students learn a variety of methods used to identify bacteria and parasites and how to prepare various antibiotic resistance tests. They also learn the basic immunological tests. Their level of knowledge at this point will allow them to apply to a clinical laboratory for advanced training as a microbiology specialist (<i>Fachmikrobiologe</i>) in the future.	Report	Written examination	9
MIB4	Agricultural and Food Microbiology Lecture Series	L	None	D: 2 sem. PRS: 1 st and 2 nd sem.	Basic knowledge of the role and function of microorganisms in food production and processing; the occurrence and importance of phytopathogenic organisms, prevention strategies and control options	None	2 written examinations (each 50%)	6
MIB5	Agricultural and Food Microbiology Lab	P*	None	D: 1 sem. PRS: 2 nd sem.	Microbiological detection methods in food microbiology and the diagnosis and epidemiology of phytopathogens	None	Report	6
MIB6	Virology Lecture	L	None	D: 1 sem. PRS: 2 nd sem.	Students will have sound theoretical knowledge in the field of virology at the end of this module.	None	Written examination	4
MIB7	Virology—Basic Laboratory Techniques	P*, S*	None	D: 1 sem. PRS: 2 nd sem.	Students are familiarized with various techniques used in basic viral research and/or viral diagnostics. When combined with lecture MIB6, students will be able to design their own approaches to solving research and diagnostic problems.	Report	Written examination	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB8	Microbiology Field Trip	FT*	None	D: 1 sem. PRS: 2 nd sem.	The microbiology field trips ensure that the degree program has practical relevance. They provide information on the use of microbiological methods and offer insights into potential lines of work.	Students participate in a total of three field trips, one in each of three of the four following areas: (1) general and applied microbiology, (2) agricultural and food microbiology, (3) virology and (4) medical microbiology. Criteria for awarding credit points: report for a field trip (ungraded)	None	3
MIB49	Master's Thesis		MIB1–MIB7 and 60 CP	D: 1 sem. PRS: 4 th sem.	Students independently plan and evaluate an experiment and prepare a research paper	None	Master's thesis	30

Elective Area A (total a minimum of 30 ECTS CP)

At least 30 ECTS CP must be obtained in Elective Area A. A maximum of 2 labs can be taken in two different working groups (different module numbers, A and B versions of modules with the same base number cannot be taken at the same time) for a total of 15 CP. One lab is to be taken in the master's thesis working group.

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB56	Literature Research and Database Analysis	E	MIB1 to MIB7, the module may not be taken at the same time as the master's thesis	D: 1 sem. PRS: 3 rd sem.	Students learn to use literature research and database analysis to theoretically examine a microbiological topic of limited scope and present it in writing in a manner that satisfies scientific requirements.	None	Term paper	6
MIB60	Industry and Research Internship (in a non-university research organization or industrial company performing research)	P*	At least three of the compulsory modules MIB1–MIB7	D: 1 sem. PRS: 3 rd sem.	Students have the opportunity to make contact with the working world at an early stage in their careers so that they can subsequently work in science and industry. The internship is aimed at putting students in a situation where they can apply the knowledge they have acquired to practical problems in a typical professional environment. Students learn to apply microbiological processes, principles and systems in practice by working on a project assigned by the company and approved by the University. By preparing a report, students learn to professionally present the results of their own work in writing.	Criteria for awarding credit points: Report (ungraded)	None	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
General Microbiology Area (Faculty of Mathematics and Natural Sciences)								
MIB9	Phototrophic Prokaryotes, Protein Purification and Fermentation Techniques	P*, S*, L	MIB1 and MIB2	D: 1 sem. PRS: 3 rd sem.	Students learn that phototrophy is not just the most important characteristic of plants, but also of many bacteria that play prominent roles as primary producers at both anoxic and oxic sites. The module allows students to understand the versatility of phototrophic organisms. It also provides the skills needed to develop concepts about how complex oxygen-producing photosynthesis could have evolved from anoxic origins.	Seminar talk	Written examination (50%), report (50%)	6
MIB10	Extremophilic Microorganisms	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 3 rd sem.	Students learn to adapt known fermentation processes to the specific needs of extremophilic bacteria and grow the organisms at high cell densities. The module also teaches students how to extract small-molecule natural products from extremophilic bacteria, process them to crystalline purity and develop and experimentally verify potential applications. It also provides the skills needed to use extremophilic bacteria as alternative expression systems.	Seminar talk	Written examination (50%), report (50%)	6
MIB12	Genetic Manipulation of Prokaryotes	P*, S*, L	MIB1 and MIB2	D: 1 sem. PRS: 2 nd sem.	Students learn how foreign DNA can be introduced into bacteria and made to function.	Seminar talk	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB13	Cellular Microbiology	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 1 st or 3 rd sem.	Students are introduced to the molecular interactions between mammalian host cells and intracellular pathogens. They learn about culturing mammalian cells, <i>in vitro</i> infection with harmless and pathogenic bacteria, fluorescence microscopy, electron microscopy and cell vitality assays.	Seminar talk and presentation	Written examination (50%), report (50%)	6
MIB14	Chemistry of Natural Products	P*	MIB72	D: 1 sem. PRS: 3 rd sem.	This course deals with the analysis and biosynthesis of natural products. Students study chromatographic (HPLC, GC, DC) and spectroscopic methods (NMR, UV) used to isolate and chemically analyze natural products. The second part of the course deals with methods used to analyze proteins and biosynthetic genes (PCR, electrophoresis).	None	Written examination (50%), report (50%)	6
MIB67-A	Microbial Physiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn to address a research question in the field of microbial physiology (e.g., adaptation to changing environmental conditions, stress adaptation, survival strategies, etc.). This includes acquiring theoretical background knowledge, planning experimental procedures and critically analyzing the data acquired.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB67-B	Microbial Physiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn to address a research question in the field of microbial physiology (e.g., adaptation to changing environmental conditions, stress adaptation, survival strategies, etc.). This includes acquiring theoretical background knowledge, planning experimental procedures and critically analyzing the data acquired. Unlike the alternative lab with the same name, MIB67-A, an in-depth experimental analysis of the problem is performed in module MIB67-B. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB17-A	Growth and Metabolism of Methanogens and Intestinal Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of methanogens and intestinal bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB17-B	Growth and Metabolism of Methanogens and Intestinal Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of methanogens and intestinal bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and detailed practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB17-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB18-A	Biotransformation of Acetic Acid Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of acetic acid bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB18-B	Biotransformation of Acetic Acid Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of acetic acid bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and detailed practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB18-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB19-A	Anoxygenic Phototrophic Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of anoxygenic phototrophic bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB19-B	Anoxygenic Phototrophic Bacteria Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of anoxygenic phototrophic bacteria. Students acquire theoretical (e.g. literature search and oral presentations) and detailed practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB19-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB53-A	Microbial Sulfur Metabolism Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of microbial sulfur metabolism. Students acquire theoretical (e.g. literature search and oral presentations) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB53-B	Microbial Sulfur Metabolism Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in general, applied and molecular microbiology using the example of microbial sulfur metabolism. Students acquire theoretical (e.g. literature search and oral presentations) and detailed practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB53-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB20-A	Cellular Microbiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in cellular microbiology. Students acquire theoretical (e.g. literature search and oral presentations) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB20-B	Cellular Microbiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in cellular microbiology. Students acquire theoretical (e.g. literature search and oral presentations) and detailed practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB20-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB52-A	Physiology and Energetics of Membrane Transport in <i>Saccharomyces cerevisiae</i> Yeast Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in the area of yeast genetics and physiology, in particular membrane physiology. Students acquire theoretical (e.g. literature search) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	None	Report (50%), presentation (50%)	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB52-B	Physiology and Energetics of Membrane Transport in <i>Saccharomyces cerevisiae</i> Yeast Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in the area of yeast genetics and physiology, in particular membrane physiology. Students acquire theoretical (e.g. literature search) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. Unlike the alternative lab with the same name, MIB52-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use techniques with such proficiency that reliable results are achieved.	None	Report (50%), presentation (50%)	9
MIB64-A	Pharmaceutical Biology Lab	P*	MIB1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Microorganisms produce many pharmaceutically important secondary metabolites. This lab gives students the opportunity to take part in current research in the field of natural product biosynthesis, in particular using polyketide synthases (PKS) and non-ribosomal peptide synthetases (NRPS). Students work on subprojects by jointly planning and then performing experiments. This allows them to learn molecular biological, analytical and <i>in silico</i> methods. The experiments performed and the results achieved are documented and discussed.	None	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB64-B	Pharmaceutical Biology Lab	P*	MIB1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Microorganisms produce many pharmaceutically important secondary metabolites. This lab gives students the opportunity to take part in current research in the field of natural product biosynthesis, in particular using polyketide synthases (PKS) and non-ribosomal peptide synthetases (NRPS). Students work on subprojects by jointly planning and then performing experiments. This allows them to learn molecular biological, analytical and <i>in silico</i> methods. The experiments performed and the results achieved are documented and discussed. Unlike the alternative lab with the same name, MIB64-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use techniques with such proficiency that reliable results are achieved.	None	Report	9

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
Medical and Pharmaceutical Microbiology Area (Faculty of Mathematics and Natural Sciences)								
MIB23	Bacterial Pathogenicity Mechanisms and Antibiotic Resistance	P*, L, S*	MIB3	D: 1 sem. PRS: 2 nd sem.	Students learn the main bacterial virulence factors that mediate colonization, adhesion, invasion and resistance to the host immune system. They also study the mechanisms that mediate antibiotic resistance and those that promote the evolution of this resistance.	Seminar talk and report	Written examination	6
MIB24	Aspects of Parasitic Immunology	P*, L, S*	MIB3	D: 1 sem. PRS: 2 nd sem.	Students are familiarized with the basic aspects of immunology and the techniques used in parasitic immunology. They study the molecular and cell biological mechanisms underlying inflammatory and immune-mediated responses during parasitic infection and how dysfunction of these processes can lead to serious host pathology. Students will be able to describe animal models of parasitic diseases, such as those used for malaria or helminth infections. They also acquire conceptual and methodological skills based on discussions of current scientific literature during the course.	Presentation	Written examination	6
MIB25	Parasitic Protozoa and Helminths	P*, L, S*	MIB3	D: 1 sem. PRS: 3 rd sem.	Students study the different modes of transmission of medically relevant vector-mediated diseases and deepen their knowledge of parasitic biology. They gain an understanding of the special characteristics of pathogens and vector-parasite interactions and their epidemiological relationships. This module teaches students to classify ectoparasites and the pathogens they transmit and use histological specimens to identify parasites and classify their relevance for human infections.	Report and seminar talk	Written examination	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB26-A	Antibiotic Biosynthesis and Antibiotic Resistance Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on antibiotic resistance mechanisms or the isolation and design of new antibiotically active peptides. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques).	Presentation	Report	6
MIB26-B	Antibiotic Biosynthesis and Antibiotic Resistance Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on antibiotic resistance mechanisms or the isolation and design of new antibiotically active peptides. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (detailed lab experiments using sophisticated techniques). Unlike the alternative lab with the same name, MIB26-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB27-A	Cell Wall Biosynthesis and Mechanisms of Antibiotic Action Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on cell wall biosynthesis and antibiotics that target this metabolic pathway. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques).	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB27-B	Cell Wall Biosynthesis and Mechanisms of Antibiotic Action Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on cell wall biosynthesis and antibiotics that target this metabolic pathway. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (detailed lab experiments using sophisticated techniques). Unlike the alternative lab with the same name, MIB27-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB28-A	Parasitology Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module gives students the opportunity to take part in a current project in the field of antihelminthic drug development. Students learn to theoretically plan and implement a research question.	Presentation	Report	6
MIB28-B	Parasitology Lab	P*, S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module gives students the opportunity to take part in a current project in the field of antihelminthic drug development. Students learn to theoretically plan and implement a research question. Unlike the alternative lab with the same name, MIB28-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB51-A	Oral Microbiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire theoretical and practical skills relating to microbial interactions with biological surfaces, in particular the structure and function of biofilms.	Seminar talk	Report	6
MIB51-B	Oral Microbiology Lab	P*, S*	MIB1 and MIB2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire theoretical and practical skills relating to microbial interactions with biological surfaces, in particular the structure and function of biofilms. Unlike the alternative lab with the same name, MIB51-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Seminar talk	Report	9
MIB55-A	Public Health-related Microbiological Hygiene Testing Methods Lab	P*, S*	MIB1, MIB2, participation in MIB3 recommended	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in the area of microbiological hygiene testing, in particular water hygiene. Students acquire theoretical (e.g. literature search) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area.	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB55-B	Public Health-related Microbiological Hygiene Testing Methods Lab	P*, S*	MIB1, MIB2, participation in MIB3 recommended	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab focuses on learning research project management and experimental procedures in the area of microbiological hygiene testing, in particular water hygiene. Students acquire theoretical (e.g. literature search) and practical knowledge (e.g. modern laboratory techniques and quality standards) in this research area. The specific questions that are dealt with experimentally and theoretically come from the field of microbiological hygiene and concern in particular drinking water and bodies of water. In addition to classical cultural methods and morphological and physiological differentiation, molecular biological and flow cytometric methods can also be used.	Presentation	Report	9
MIB70-A	One Health Lab	P*, S*	MIB3-MIB7	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab introduces students to the structural planning, preparation, implementation and evaluation of various One Health related topics. Students use theoretical (e.g. literature research) and practical methods (e.g. current lab techniques) to learn about the broad diversity of this research focus. An interdisciplinary working group allows microbiological questions focusing on various areas in human medicine, agricultural sciences and environmental hygiene to be addressed. A variety of methods are used to test and evaluate the hypotheses.	None	Report (50%), presentation (50%)	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB70-B	One Health Lab	P*, S*	MIB3-MIB7	D: 1 sem. PRS: 2 nd or 3 rd sem.	This lab introduces students to the structural planning, preparation, implementation and evaluation of various One Health related topics. Students use theoretical (e.g. literature research) and practical methods (e.g. current lab techniques) to learn about the broad diversity of this research focus. Unlike the alternative lab with the same name, MIB70-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved. An interdisciplinary working group allows microbiological questions focusing on various areas in human medicine, agricultural sciences and environmental hygiene to be addressed. A variety of methods are used to test and evaluate the hypotheses.	None	Report (50%), presentation (50%)	9
Virology Area (Faculty of Medicine)								
MIB29	Virology—Molecular Biological and Immunobiochemical Techniques	P*, S*, L	MIB6 and MIB7	D: 1 sem. PRS: 2 nd sem.	This course is intended for advanced students and focuses on molecular techniques in virology (e.g. reverse genetics) and aspects related to the innate immune response.	Report	Written examination	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB30-A	Molecular Biology and Innate Immune Response in Virology Lab	P*, S*	MIB6, MIB7 and MIB29	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in ongoing research in the field of plus-strand RNA viruses. Students use reverse genetics and other molecular biological techniques to study the functions of viral proteins. Other projects deal with the molecular characterization of virus-host interactions, with a focus on the innate immune system of bats. Students acquire theoretical (literature research, data analysis, reporting, presentations) and practical knowledge (experimental lab work, special lab techniques) in these research areas.	None	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB30-B	Molecular Biology and Innate Immune Response in Virology Lab	P*, S*	MIB6, MIB7 and MIB29	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in ongoing research in the field of plus-strand RNA viruses. Students use reverse genetics and other molecular biological techniques to study the functions of viral proteins. Other projects deal with the molecular characterization of virus-host interactions, with a focus on the innate immune system of bats. Students acquire theoretical (literature research, data analysis, reporting, presentations) and detailed practical knowledge (experimental lab work, special lab techniques) in these research areas. Unlike the alternative lab with the same name, MIB30-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	None	Report	9

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
Agricultural and Food Microbiology Area (Faculty of Agriculture)								
MIB31	Molecular Methods in Microbial Ecology—Focus on Soil Microbiology	P*, L	None	D: 1 sem. PRS: 2 nd sem.	Students learn classical and current methods of soil microbiology and their specific uses for studying microbial populations and their activities in the soil ecosystem. The course has a special focus on molecular methods for characterizing microbial communities in soils. Students acquire practical skills by using selected methods for the analysis of soil-dwelling microorganisms in the exercises.	None	Report	6
MIB33	Plant-Pathogen Interactions	L, S*, P*	MIB4, 1 st part	D: 1 sem. PRS: 2 nd or 4 th sem.	Students acquire in-depth knowledge of the emergence and development of interactions between crops and pathogenic organisms, the biology of infection, the colonization and damaging effects of phytopathogenic fungi and oomycetes on crops, (resistance) reactions of host plants to infestation at the microscopic and molecular levels, interactions and mutual influence of plants and pathogens. After completing the module, students will be able to understand the infectious behavior of various pathogens, assess host-pathogen interactions at different levels and develop strategies to prevent pathogen infestation of plants.	Presentation	Written examination	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB34	Plant Pathology Project Work	L, S*, P*	None	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students perform experimental work on questions in the field of plant pathology and plant protection, perform experiments in the laboratory and greenhouse, collaborate on research projects, plan, perform, document and interpret research experiments and apply new or project-specific methods. After completing the module, students will be able to formulate research questions, assess and apply research methods and interpret the results of their own experiments based on the literature.	Presentation	Term paper	6
MIB35-A	Agricultural and Food Microbiology Lab	P*, S*	MIB4 and MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research in the field of agricultural and food microbiology. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques).	Presentation	Report	6
MIB35-B	Agricultural and Food Microbiology Lab	P*, S*	MIB4 and MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research in the field of agricultural and food microbiology. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (detailed lab experiments using sophisticated techniques). Unlike the alternative lab with the same name, MIB35-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB54	Phytomedicine Lab	P*	None	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research in the field of phytomedicine. Students acquire theoretical knowledge (literature research, data mining, record keeping, presentation techniques) and practical skills (detailed lab experiments).	Presentation	Report	9
MIB61	Cold Chain Management	L, S*, P*	None	D: 1 sem. PRS: 3 rd sem.	After completing the module, students will have a sound knowledge of the challenges and solutions for optimizing cool chain management in national and international supply chains. In particular, innovative methods for improving the quality and safety of foods requiring refrigeration are explained. After completing the module, students will be familiar with the logistical processes in different cold chains and have a sound knowledge of the challenges and solutions for optimizing cool chain management in national and international supply chains. This includes the ability to set up and optimize processes for improving food safety and the quality of products requiring refrigeration.	Seminar talk	Written examination	6
MIB71-A	Microbiological Aspects of Cold Chain Management Lab	P*, S*	MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on the microbiological aspects of cool chain management. Students acquire theoretical knowledge (literature research, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques).	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB71-B	Microbiological Aspects of Cold Chain Management Lab	P*, S*	MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on the microbiological aspects of cool chain management. Students acquire theoretical knowledge (literature research, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques). Unlike the alternative lab with the same name, MIB71-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9
MIB63-A	Soil Microbiology Lab	P*, S*	MIB1	D: 1 sem. PRS: 2 nd or 3 rd sem.	The course gives students the opportunity to work on a current research project related to soil-dwelling or plant-associated microorganisms. Students acquire theoretical knowledge (literature research, data analysis, record keeping, presentation techniques) and practical skills (planning and performing lab experiments).	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB63-B	Soil Microbiology Lab	P*, S*	MIB1	D: 1 sem. PRS: 2 nd or 3 rd sem.	The course gives students the opportunity to work on a current research project related to soil-dwelling or plant-associated microorganisms. Students acquire theoretical knowledge (literature research, data analysis, record keeping, presentation techniques) and practical skills (planning and performing lab experiments). Unlike the alternative lab with the same name, MIB63-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to produce reliable results that can also be evaluated statistically.	Presentation	Report	9
MIB66-A	Microbiological Aspects of Food Technology Lab	P*, S*	MIB4 and MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on the microbiological aspects of food technology. Students acquire theoretical knowledge (literature research, record keeping, presentation techniques) and practical skills (lab experiments using sophisticated techniques).	Presentation	Report	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB66-B	Microbiological Aspects of Food Technology Lab	P*, S*	MIB4 and MIB5	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course gives students the opportunity to take part in current research on the microbiological aspects of food technology. Students acquire theoretical knowledge (literature research, record keeping, presentation techniques) and practical skills (detailed lab experiments using sophisticated techniques). Unlike the alternative lab with the same name, MIB66-A, an in-depth experimental analysis of the problem is performed in this module. This broadens the learning objectives, since students gain the skills to use complicated laboratory techniques with such proficiency that detailed, reliable results are achieved.	Presentation	Report	9

Elective Area B—a maximum of 5 of the 13 modules are to be chosen (total of 15 ECTS CP)

A maximum of 15 ECTS CP can be obtained from modules in Elective Area B.

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB36	Microbiology Seminar and Colloquium	S*, C*	MIB1–MIB7 and another 18 CP from other modules	D: 1 sem. PRS: 4 th sem.	During one semester, students attend 10–14 colloquia by research groups in the Institute of Microbiology and Biotechnology and national and international guests. Students also present their master's thesis in the colloquium. During the discussions following the lectures, students learn to critically assess their own research work and the work presented by others. Students also take part in the seminars for their respective research groups for master's and doctoral students. The topics and current results of the students' master's and doctoral theses are presented and discussed during these seminars, and current literature in the area of research is presented and critically examined.	Criteria for awarding credit points: two presentations ^r (ungraded)		3
MIB65	Current Topics in General and Applied Microbiology	S*	None	D: 1 sem. PRS: 2 nd sem.	Students learn about current topics in general and molecular microbiology.	None	Seminar talk ^r	3
MIB43	Bioinformatics 1	L	None	D: 1 sem. PRS: 3 rd sem.	Basic knowledge of applied bioinformatics	None	Written examination	3
MIB45	Mechanisms of Antibiotic Action and Resistance	S*	MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire an in-depth understanding of the molecular mode of action of antibiotics and build on this to learn the strategies and mechanisms bacteria use to develop resistance. This knowledge is then used in discussions about the optimal use of antibiotics.	None	Seminar talk ^r	3

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB46	Viral Infection Strategies	S*	None	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire in-depth knowledge of virology during the seminar. They learn, in particular, how viruses in individual virus families differ with respect to certain aspects of the viral life cycle. This knowledge is then used in discussions about the possibility of establishing antiviral strategies.	Preparation of a hand-out for the presentation	Seminar talk ^r	3
MIB47	Zoonoses	S*, FT*	None	D: 1 sem. PRS: 4 th sem.	After completing the module, students will understand the basics of infection transmission between animals and humans, be familiar with the clinical picture and modes of infection of the main zoonoses (e.g. BSE, salmonellosis), have an interdisciplinary understanding of public health, the legal basis and enforcement of required measures and know the importance of feed and food logistics in the spread of zoonoses.	None	Seminar talk ^r	6
MIB68	Health and Crisis Management	L, E*	None	D: 1 sem. PRS: 4 th sem.	After completing the module, students will know the basics and principles of occupational health and crisis management and be able to use scientific findings and methods to plan, implement and evaluate occupational health management measures and apply the various methods and concepts used in risk analysis.	Presentation	Oral examination	6
MIB59	Ecologies of Health and Disease	S*	None	D: 1 sem. PRS: 3 rd sem.	Students acquire in-depth knowledge of the ecologies of health and disease. This knowledge is then used in discussions about possible health-related risk management.	None	Seminar talk ^r (40%), term paper (60%)	6
MIB62	Oral Microbiology Seminar	S*, L	MIB1 and MIB3	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire theoretical skills related to microbial interactions with eukaryotic cells, in particular inflammatory processes and tumor development, and the methods for studying them.	None	Written examination	3

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB23T	Bacterial Pathogenicity Mechanisms and Antibiotic Resistance: Theory Part	S*, L	MIB3	D: 1 sem. PRS: 2 nd sem.	The theory part of course MIB23 includes the seminar and students. Students learn the basics of immunology and the main virulence factors of pathogenic bacteria that mediate colonization, adhesion, invasion and resistance to the host immune system. They also gain an understanding of the mechanisms that mediate antibiotic resistance and the evolution and selection of this resistance.	Seminar talk	Written examination	3
MIB69	Bacteria as Pathogens in the Tropics	S*	None	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire in-depth knowledge of the bacterial pathogens of topical diseases during the seminar. They also gain insights into the detection of these pathogenic bacteria in rural settings and an overview of major epidemics and current crisis areas. This knowledge is then used to discuss strategies for rational antibiotic therapy and resistance containment in the tropics.	None	Seminar talk ^r	3
MIB72	Chemistry of Natural Products Seminar	S*	None	D: 1 sem. PRS: 3 rd sem.	This seminar deals with the analysis and biosynthesis of natural products. Students acquire theoretical knowledge about the isolation and chemical analysis of natural products. They also acquire theoretical knowledge about biosynthetic genes and proteins.	None	Seminar talk ^r	3

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
MIB48	Research and Industry Internship (in a non-university research organization or industrial company performing research)	P*	Students must have passed at least three of the compulsory modules MIB1–MIB7	D: 1 sem. PRS: 3 rd sem.	Students have the opportunity to make contact with the working world at an early stage in their careers so that they can subsequently work in science and industry. The internship is aimed at putting students in a situation where they can apply the knowledge they have acquired to practical problems in a typical professional environment. Students learn to apply microbiological processes, principles and systems in practice by working on a project assigned by the company and approved by the University. By preparing a report, students learn to professionally present the results of their own work in writing.	Criteria for awarding credit points: Report (ungraded)	None	6

The examination board may approve further elective modules and shall announce them before the beginning of the semester pursuant to § 8, para. 7.

Annex 2: Module structure for the master's degree program Molecular Cell Biology

Module structure key:

- Abbreviations of course types: L = lecture, P = practical work/lab work, S = seminar
- Marked with asterisk (*): Courses for which the examination board may, pursuant to § 12, para. 6, require compulsory attendance as prerequisite for participation in the module examination (field trips, language courses, lab courses, practical exercises as well as comparable courses). In these cases, compulsory attendance is an additional requirement to the other coursework listed.
- The "Course Type" column shows the type of a course within the module.
- The "Duration/Program-Related Semester" column shows the duration of the module (in semesters) and assigns it to a specific program-related semester.
- The "Coursework" column shows requirements that must be met for admission to certain examinations pursuant to § 12, para. 4 or, respectively, to acquire ECTS credit points in modules without an examination. Coursework that is required for admission to certain examinations and must be repeated in case that examination is failed is marked with the letter "r" (r).
- In the "Type of Examination" column, examinations as defined by § 14, para. 6 that cannot be repeated within one semester but must rather be repeated along with the entire module or, respectively, the corresponding course are marked with the letter "r" (r).

The examination board shall make further details on individual modules, especially regarding the courses offered within or required for completion of a module, available in a module guide before the beginning of the respective semester pursuant to § 8, para. 7.

1st and 2nd Academic Year—Compulsory Modules

Module Code	Module Name	Course Type	Admission Requirements	Duration/Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-P1	Biochemistry	L, S*	None	D: 1 sem. PRS: 1 st sem.	Deeper understanding of the biochemical basis of the cell. Characteristics and biosynthesis of proteins, nucleic acids and lipids. Energy metabolism pathways, enzymes, enzyme reactions and co-enzymes. Post-translational modifications as a regulatory principle, detection methods.	None	Written examination	4

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-P2	Molecular Genetics	L, S*	None	D: 1 sem. PRS: 1 st sem.	Understanding of the principles of gene regulation and the methods of molecular genetics. Translation of genetic information, regulation of gene expression, translational control, post-transcriptional mechanisms, epigenetics. Methods of molecular biology, manipulation of nucleic acids, genome editing. Recombinant proteins, techniques and principles. Working with genomic data and databases. Basics of the immune system with respect to antibody production. Antibody production and applications.		Written examination	4
MCB-P3	Developmental Biology and Physiology	L, S*	None	D: 1 sem. PRS: 1 st sem.	Understanding of cellular and molecular biological requirements for multicellularity and for organismal processes during development. Knowledge of the methodology for analyzing these processes. General principles of development; signaling pathways and decision mechanisms of cell differentiation, cell division: mitosis, meiosis, germ cells; understanding of the principles of development processes in animals and plants; pattern formation, tissue differentiation, organ development; tissue homeostasis and germ cells; cellular aging; reproductive medicine.		Written examination	4
MCB-P4	Molecular Cell Biology	L, S*	None	D: 1 sem. PRS: 1 st sem.	Deeper understanding of cell organization and cellular processes. Organelles and compartments and their function. Cytoskeleton and motors as organizing elements, membrane transport and general transport processes, ion channels. Protein sorting and proteostasis, apoptosis.		Written examination	4

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-P5	Biophysics and Statistics	L, S*	None	D: 1 sem. PRS: 1 st sem.	Insights into biophysical methods and introduction to the statistical analysis of experiments. Introduction to biophysical and chemical calculations, biophysical principles of optics and microscopy, enzyme kinetics, spectroscopic methods in molecular biology, theory and methods of molecular interactions, separation methods of macromolecules, application of statistical methods to experimental data sets.		Written examination	4
MCB-MBC	Mandatory Basic Course	P	None	D: 1 sem. PRS: 1 st sem.	Basic methods of molecular biology are learned in practice and performed independently. The course lays the foundation for subsequent elective modules. It covers: cell culture techniques, cell fractionation methods, isolation of nucleic acids and cloning, buffer calculations, protein biochemistry techniques, application of antibodies, histology and microscopic methods. Detection and quantification of gene expression.	Regular participation in practical exercises	Report	8
MCB-XM	Examination Module		None	D: 1 sem. PRS: 1 st sem.	Proof of the qualification objectives of compulsory modules MBC-P1 to MCB-P5	MCB-P1 to MCB-P5 taken	Oral examination	2
MCB-TSS	Teacher Seminar Series	S*	None	D: 1 sem. PRS: 2 nd sem.	The instructors present special topics in molecular biology and current research results in this seminar series.		Research proposal (abstract)	2
MCB-SSC	Soft Skills/Bioethics	L, S*	None	D: 1 sem. PRS: 2 nd sem.	Presentation, lab reports, scientific paper, bioethics		Poster (50%), written examination (50%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-SJC	Seminars/Journal Club	S*	None	D: 1 sem. PRS: 2 nd sem.	Seminar attendance, participation in journal clubs on current research topics		Research proposal (abstract)	3
MCB-SP	Student Presentation	S	MCB-EM91 MCB-EM92 MCB-PE	D: 1 sem. PRS: 3 rd sem.	Presentation of results from the Rotations and Project/Exchange	None	Presentation	2
MCB-MT	Master's Thesis		MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX and min. 78 CP	D: 1 sem. PRS: 4 th sem.	The knowledge and practical skills acquired during the student's studies are applied to a defined research question, experiments are planned and performed independently and a research paper is prepared.	Presentation generally two weeks before submission of the master's thesis	Master's thesis'	30

1st and 2nd Academic Year—Elective Modules

Modules with a total of 48 ECTS CP must be chosen.

Students must choose four (4) of the elective modules (MCB-EM1 to MCB-EM24) and take two Rotations (MCB-EM91 and MCB-EM92) and the Project/Exchange (MCB-PE). [Note: in the case of modules MCB-EM1 to MCB-EM24, a distinction is made between biology modules (A) and modules for other subjects (B). At least one A elective module must be taken.]

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM1	Analysis of snRNP Assembly (A module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Culture techniques for different cell lines, live cell imaging, manipulation of intracellular proteins with RNAi, gene knockout and small-molecule inhibitors, protein detection and quantification after knockdown or knockout, light microscopy including indirect immunofluorescence, quantitative image analysis. Use of sophisticated molecular biological techniques, independent planning and performance of experiments.		Report	5
MCB-EM2	Optogenetics (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Purification of nucleic acids, cell culture techniques, transfection, gene expression studies, microscopy and fluorescence-based imaging, optogenetics Use of optogenetics in tissue culture, use of sophisticated molecular biological techniques, independent planning and performance of experiments.		Report	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM3	Molecular Biology of the Cell (A module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Cell culture techniques, differentiation and manipulation of cultured cells, cell transfection and transduction, knockdown of gene expression, high-resolution live cell microscopy of fluorescent proteins, analysis of protein localization, interaction and dynamics in living cells Use of sophisticated molecular biological techniques, independent planning and performance of experiments.		Report	5
MCB-EM4	Mechanical Stress Protection (A module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Cell culture techniques, recombinant protein expression, protein purification, muscle cell differentiation, electropulse stimulation as a training model, immunoprecipitation and the yeast 2-hybrid system, microscopic imaging techniques, analysis of protein degradation pathways Advanced biochemical and cell biology methods for studying the molecular mechanisms of mechanical stress protection		Report (70%), seminar talk ^r (30%)	5
MCB-EM5	Neuronal Cell Biology (A module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Neuronal cell culture, transfection of neurons, immunocytochemistry, fluorescence microscopy, live cell imaging, tissue imaging Use of sophisticated neuronal cell biology techniques, independent planning and performance of experiments		Report (50%), oral examination (50%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM6	Transport Physiology (A module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Examples of plant-environment interactions from the molecular to the organismal level, water and salt stress, effects of xenobiotics on plants, plant-microorganism interactions and plant secondary metabolites. Use of modern techniques of molecular plant physiology, independent planning and performance of experiments		Written examination	5
MCB-EM7	Pharmacology & Metabolism (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Study of major metabolic pathways using small-molecule modulators in the mouse model, handling of experimental animals, extraction of murine primary adipocytes, use of <i>in vivo</i> , <i>ex vivo</i> and <i>in vitro</i> model systems, culture of human adipocytes; seminar on signal transduction, metabolism and pharmacology.		Report	5
MCB-EM8	Plant Transformation (A module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Plant transformation with reporter constructs (leaf discs), <i>Agrobacterium</i> -mediated transformation, cloning in <i>Escherichia coli</i> and <i>Agrobacterium tumefaciens</i> , detection of transgenic organisms.		Report	5
MCB-EM9	Quantitative Fluorescence Microscopy (B module)	L, P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Transient and stable expression of fluorescent proteins, SNAP, halo and clip-tag labeling, high-resolution confocal laser scanning microscopy, FRAP, analysis of intracellular protein mobility, FRET, quantitative image analysis, 3D image reconstruction Use of sophisticated light microscopy techniques of molecular cell biology, independent planning and performance of experiments		Report	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM10	Biochemistry and Bioanalytics (B module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Expression of recombinant proteins in <i>E. coli</i> , protein purification and analysis, binding and activity studies, enzyme kinematics and enzyme and protein regulation In-depth knowledge and practical application of modern biochemical and bioanalytical techniques and methods, independent planning and performance of experiments and assessment of original literature		Report (70%), seminar talk ^r (30%)	5
MCB-EM11	Molecular Membrane Biology (A module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Cell culture with macrophages and epithelial cells, subcellular fractionation and analysis of fractions, membrane purification, membrane fusion with purified components, knockdown of gene expression with siRNA, fluorescence microscopy, electronic image analysis Use of sophisticated techniques of molecular cell biology, independent planning and performance of experiments		Report (70%), seminar talk ^r (30%)	5
MCB-EM12	Bioinformatics Lab Course (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Practical introduction to algorithms, biology databases, modeling, programming; application-oriented basic knowledge of bioinformatics methods		Report	5
MCB-EM13	Embryo Biotechnology (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Overview of the creation of transgenic animals, teaching the use of transgenic animals in biological research and biotechnological use		Report	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM14	Drugs from Plants and Microorganisms (B module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Students gain an overview of the various classes of natural products, their analytics, extraction, structure and physiological activity and wide variety of uses in medicine that allows them to discuss simple structure-activity relationships.		Report (34%), seminar talk ^r (33%), written examination (33%)	5
MCB-EM15	Biosyntheses of Natural Products (B module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Students gain an overview of the structures and biosynthesis of natural products. They learn about the molecular biological analysis and identification of biosynthetic genes, enzymes and proteins.		Report (34%), seminar talk ^r (33%), written examination (33%)	5
MCB-EM16	Proteomics (B module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Students gain the skills to extract proteins from the tissues of model organisms that have been extensively characterized by molecular genetics and use mass spectrometry to identify them. In addition, standard protein biochemical methods are used to perform a general analysis and an analysis of selected post-translational modifications. Participants also learn to use advanced analysis techniques to characterize the extracted proteins down to their molecular structure.		Report (50%), seminar talk ^r (50%)	5
MCB-EM17	Preventive, Predictive and Personalized Medicine (B module)	P*, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Pathogenesis mechanisms of secondary cardiovascular complications in type II diabetes mellitus, neurodegenerative diseases and selected tumors, stress and repair mechanisms, tissue reconstitution, pathology-specific expression patterns		Report (60%), seminar talk ^r (20%), written examination (20%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM18	Cell Mechanics (A module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Analysis of various mechanical signals in animal organisms, combination of chemical and mechanical signals, cellular mechanics in adhesion and migration processes, response of animal cells, substrate elasticity, topography, analysis of viscosity and elasticity in cells.		Report	5
MCB-EM19	Biochemical Engineering (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Practical introduction to the basics and main aspects of bioprocess engineering: Possibilities and limits of processes at different process steps as a prerequisite for biotechnology process development.		Report	5
MCB-EM20	Fluorescent Protein-based Biosensors (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Biotechnological production and validation of biosensors, use of GFP-based probes for dynamic <i>in vivo</i> measurements of physiological parameters and the analysis of membrane proteins		Report	5
MCB-EM21	Genome Stability (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Experimental approach to questions of telomere biology, independent experimental planning using yeast as a model system, protein purification and molecular biological methods		Report	5
MCB-EM22	Reconstructive Neurobiology (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Genome editing with CRISPR/Cas9 and generation of neuronal iPS in regard to brain development and pathology, immunochemistry, <i>in situ</i> hybridization and cell culture as basic methods.		Seminar talk ^r	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM23	Applications of CrispR/Cas to Study Neuronal Function (B module)	P*, L, S*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Use of CRISPR/Cas9, viral vector production in neurobiological research, introduction to data analysis		Report (50%), seminar talk ^r (50%)	5
MCB-EM24	Methods in Developmental and Tumor Pathology (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Isolation of RNA from animal cells or tissue, reverse transcription, PCR, gene-specific PCR reactions, quantitative real-time PCR, gel electrophoresis, <i>in situ</i> hybridization, fragment sequencing.		Report	5
MCB-EM25	Molecular Haematology (B module)	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 2 nd sem.	Identification of coagulopathies, detection of coagulation factor inhibitory antibodies; DNA preparation from blood, PCR, sequencing, analysis of identified mutation to characterize the phenotype; cloning of cDNA into a vector using restriction-free cloning PCR, mutagenesis PCR, transfection and expression in mammalian and CRISPR/Cas9-modified cell lines, coagulation assays; induction, characterization and culture of pluripotent stem cells (iPS) for reprogramming human and murine (WT) blood, differentiation into endothelial cells, protein modeling of WT and mutant protein		Report	5
MCB-EM91	Rotation 1	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Participation in ongoing research projects		Report	8

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework Required for Admission to Examinations	Type of Examination	ECTS CP
MCB-EM92	Rotation 2	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX	D: 1 sem. PRS: 3 rd sem.	Participation in ongoing research projects		Report	8
MCB-PE	Project/Exchange	P*	Passing grades for basic modules MCB-P1 to MCB-P5, Mandatory Basic Course MCB-MBC and Examination Module MCB-MX and a minimum of 60 CP	D: 1 sem. PRS: 3 rd sem.	Independent experimental work in the laboratory		Report	12

The examination board may approve further elective modules and shall announce them before the beginning of the semester pursuant to § 8, para. 7.

Annex 3: Module structure for the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology)

Module structure key:

- Abbreviations of course types: FT = field trip, P = practical lab work, PW = practical work, S = seminar, T = tutorial, E = scientific exercise, L = lecture, C = colloquium.
- Marked with asterisk (*): Courses for which the examination board may, pursuant to § 12, para. 6, require compulsory attendance as prerequisite for participation in the module examination (field trips, language courses, lab courses, practical exercises as well as comparable courses). In these cases, compulsory attendance is an additional requirement to the other coursework listed.
- The "Course Type" column shows the type of a course within the module.
- The "Duration/Program-Related Semester" column shows the duration (D) of the module (in semesters) and assigns it to a specific program-related semester (PRS).
- The "Coursework" column shows requirements that must be met for admission to certain examinations pursuant to § 12, para. 4 or, respectively, to acquire ECTS credit points in modules without an examination. Coursework that is required for admission to certain examinations and must be repeated in case that examination is failed is marked with the letter "r" (r).
- In the "Type of Examination" column, examinations as defined by § 14, para. 6 that cannot be repeated within one semester but must rather be repeated along with the entire module or, respectively, the corresponding course are marked with the letter "r" (r).

The examination board shall make further details on individual modules, especially regarding the courses offered within or required for completion of a module, available in a module guide before the beginning of the respective semester pursuant to § 8, para. 7.

Compulsory Modules

Module Code	Module Name	Course Type	Admission Requirements	Duration/Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-M1	Biodiversity and Evolution	L*, S*, FT*	None	D: 1 sem. PRS: 1 st sem.	Students acquire basic knowledge of plant and animal biodiversity and evolution, practice presenting and assessing literature sources and learn how to systematically process animal and plant species.	Presentation, research proposal (data sheets)	Written examination	10
OEP-M2	Fundamentals of Evolutionary Biology	L, S*, PW*	None	D: 1 sem. PRS: 1 st sem.	Students learn the basics of evolutionary theory, phylogenetics, ecology, paleontology and physiology. They practice critically assessing current literature based on key evolutionary biology concepts and perform computational cladistic analysis.	Presentation	Written examination	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-M3	Scientific Communication	L, S*, PW*	None	D: 1 sem. PRS: 1 st sem.	Students train in the practice and theory of communication in the evolutionary sciences and learn to write abstracts and publications and design posters and presentations.	None	Seminar talk (50%), research proposals (written graded projects (25%), abstracts (10%), 2 methodology worksheets (each 7.5%))	5
OEP-M4	Biological Colloquium	C*	None	D: 2 sem. PRS: 2 nd and 3 rd sem.	Speakers from outside the University present current topics in organismic biology in individual sessions. Students develop a culture of critical inquiry and learn different styles of presentation.	Research proposal (abstracts)	None	2
OEP-M5	Thesis Defense	S*	OEP-M4	D: 2 sem. PRS: 4 th sem.	Students defend their own research results in their master's thesis; students should present an overview of current and past biodiversity and evolutionary constraints and processes.	Presentation	Oral examination	3
OEP-M6	Master's Thesis		OEP-M1 to OEP-M4 and 60 CP	D: 1 sem. PRS: 4 th sem.	Students independently plan and evaluate an experiment and prepare a research paper.	None	Master's thesis	30

Elective Modules

Modules totaling 60 ECTS CP must be chosen from Elective Areas A, B, C, with a minimum of 15 and a maximum of 30 ECTS CP in each area.

Elective Area A (teaching of methods)—2 to 6 of the 23 modules are to be chosen (total a minimum of 15 and maximum of 30 ECTS CP)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A01	Analysis of Form and Function in Living Systems	L, S*, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students study morphology, class. mechanics, statistics, programming (R) and quantitative image analysis by means of experiments on different insects	Report, presentation	Oral examination	10
OEP-A02	Bioinformatics for Master Students—Beginner's Course	L, P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain the skills needed for many of today's bioinformatic challenges. They learn the PYTHON programming language to perform basic analyses with sequence data and implement automated database queries.	Research proposal (data sheet)	Written examination	10
OEP-A03	Beginner's Course: Programming in C/C++	L, P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn the fundamentals of the C/C++ programming language and design and develop algorithms to solve simple problems.	Research proposal (data sheet)	Written examination	5
OEP-A04	Theory and Practice of Phylogenetic Systematics	L, S*, P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain a broad overview of the theoretical concepts on the use and application of real data sets. Knowledge of these theoretical aspects is necessary for successful analysis of molecular data sets.	Report, presentations, research proposal (data sheet)	Written examination	10
OEP-A05	Principles of Taxonomy: Weekend Seminar	S*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This seminar focuses on general principles of taxonomy and classification, including zoological nomenclature and scientific theory, procedures and methods of taxonomy and species delimitation.	None	Written examination	2.5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A06	Bioinformatics and Evolutionary Genomics	L, P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module introduces approaches and methods for understanding evolutionary processes using molecular sequences and genomic data sets. It introduces bioinformatic principles, databases and freely available software packages, and teaches creative use of the Unix environment and command line-based programming.	None	Report (50%), presentation (50%)	10
OEP-A07	Histology, Tomography, and Computer-Aided 3D Reconstruction of Animal Anatomy	L, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students are taught to use tomographic imaging techniques, produce and interpret histological sections, generate 3D models of selected organ systems and publicly archive data. They learn how anatomical studies help reveal phylogenetic relationships among metazoans.	None	Poster (33%), presentation (33%), report (34%)	10
OEP-A08	Morphological Character Analysis in Phylogenetics	L, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module aims to improve understanding of how comparative morphology is applied to phylogenetic systematics. The main objectives are to learn how coding strategies in morphology impact on cladistic analyses, and test published results on and the effect of cladograms on the interpretation of phenotypic evolution.	Presentation, research proposal (data sheet)	Written examination	5
OEP-A09	Application of Immunohistochemistry in Invertebrate Systematics	S, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides an introduction to techniques for studying the early development of muscular and nervous systems in invertebrates using confocal laser scanning microscopy (cLSM). The main objectives are to learn how to interpret immuno- and fluorescent stainings and assess the information on organogenesis provided by such studies and their contribution to phylogenetic analyses.	Report, presentation	Written examination	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A10	Application of Electron Microscopy in Invertebrate Systematics	S*, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	This course provides an introduction to transmission electron microscopy techniques and tissue preparation and ultrathin sectioning methods. Students also learn to interpret ultrastructural data using the example of larval organ systems.	Presentation	Report	5
OEP-A11	Practical Course on Electron Microscopy	S*, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module teaches the practical application of raster and transmission electron microscopy techniques (SEM, TEM), from fixation to gold-coated specimens and ultrathin sections. Students learn to interpret electron microscopy data and gain insights into the ultrastructure of invertebrates.	Presentation	Report	5
OEP-A12	DNA Barcoding: Identifying and Describing Biodiversity	L, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides insights into different species concepts and the use of modern molecular methods for identifying and describing animal species. Examples from current literature are presented and discussed. Students also analyze their own data sets to gain practical experience with DNA barcoding.	Presentation	Report	5
OEP-A13	Structural and Materials Science Characterization of Biological Materials and Receptors	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire sound knowledge of the preparation and testing of the material properties of different biological samples down to the micro and nanoscale. They develop confidence in their decisions concerning the selection, preparation, fixation and embedding of samples, cutting and/or polishing of surfaces and subsequent testing with an AFM and nanoindenter.	None	Presentation (50%), research proposal (data sheet) (10%), report (40%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A14 /PMEP	Molecular Evolution and Phylogeny	L, S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides insights into the evolution of land plants from a molecular genomic perspective. Students learn to answer questions about molecular biological techniques, the diversity of land plant crops and the different approaches to molecular phylogenetic analysis. The module teaches molecular techniques, such as DNA and RNA extraction, cDNA synthesis, PCR amplification, cloning and sequencing, and uses programs for database analysis and molecular phylogenetic tree reconstruction.	Reports, presentation	Written examination	5
OEP-A15/PBCO1	Geographic Information Systems (GIS) for Plant Biogeography & Conservation	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 3 rd sem.	This module teaches students how to design and perform analyses in the fields of macroecology, biogeography and nature conservation using geographical information systems (GIS). The module combines an introduction to mapping and spatial data analysis with theory and exercises from the fields of macroecology and biogeography. A special focus is placed on analyses of the impact of global environmental change on biodiversity.	None	Presentation (60%), reports (40%)	5
OEP-A16/PBCO2	Biodiversity Informatics: Data Analyses for Ecology and Biogeography	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 3 rd sem.	Students learn to design and perform analyses in the fields of (macro)ecology and biogeography using code-based analysis software such as R or Julia. The module provides an overview of the methods commonly used to analyze and model data in the fields of ecology (incl. macroecology) and biogeography.	None	Presentation (60%), reports (40%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A17 /TPP	Transport Physiology	P*	OEP-B12/PBPM0, OEP-M2	D: 1 sem. PRS: 2 nd sem.	Interactions between plants and their environment are studied experimentally from the molecular to the organismic level. This includes studies of water and salt stress, the effects of xenobiotics on plants, interactions with microorganisms and secondary plant metabolism. Modern methods of molecular plant physiology and ecology are introduced. Students learn different methods of transport physiology, gain experience in planning and performing experiments independently and learn how to present their own experimental results.	Statistical and graphical analysis and presentation of own experimental results	Written examination	10
OEP-A18/MBRE	Modern Biodiversity Research: From Population Genetics to Phylogenomics	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 3 rd sem.	Students gain an in-depth understanding of molecular evolutionary processes based on changes in DNA sequences. The focus is on using this information for phylogenetic and evolutionary analyses.	None	Presentation (30%), reports (70%)	10
OEP-A19/PEPL	Plant Evolution and Phylogeny Lab	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain a sound understanding of the evolution of land plants based on genomic data. The taxonomic focus is on representatives of lower land plants, the bryophytes, lycophytes and monilophytes, and the methodological focus is on plant mitochondrial DNA with their specific mechanisms of gene expression, such as RNA editing and trans-splicing.	Report	Presentation	10
OEP-A20	Chemistry of Natural Products	S*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with the analysis and biosynthesis of natural products. Students learn various techniques to isolate and characterize secondary metabolites, such as chromatographic and spectrophotometric methods. The second part of the course deals with methods used to analyze and identify enzymes, proteins and biosynthetic genes.	(Oral) presentation	Written examination	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-A21	Advanced Methods in Organismic Biology, Evolutionary Biology or Paleobiology	P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain experimental skills for analyzing biodiversity and evolution and learn about functional constraints, evolutionary adaptations and structural details of surviving and extinct animals and plants. The module focuses on teaching methodological skills. The module is a lab course and is individually arranged.	None	Report	10
OEP-A22	Advanced Computer Skills in Organismic Biology, Evolutionary Biology or Paleobiology	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 3 rd sem.	This module deals with specific topics concerning the use of (bio)informatics for the visualization of structures and modeling of evolutionary processes and the relationships between structure and function. The course focuses on learning specific informatics skills.	None	Report	10
OEP-A23	Advanced Bioinformatics in Phylogenetics, Evolutionary Biology and Biodiversity Research	P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 3 rd sem.	This module deals with specific topics concerning the use of (bio)informatics for the analysis of evolution, phylogenetics, biogeography and biodiversity monitoring. The course focuses on learning specific bioinformatics skills.	None	Report	10

Elective Area B (modules with fieldwork < 50%)—2 to 6 of the 30 modules are to be chosen (total a minimum of 15 and maximum of 30 CP)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B01	Environment and Behavior: Theory	S*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module teaches concepts and methods in all areas of behavioral biology, such as classical ethology, sociobiology, behavioral physiology and neuroethology. Behavioral biology is presented as a hypothesis-driven science that follows either a proximate or ultimate approach.	None	2 seminar talks (each 50%)	5
OEP-B02	Environment and Behavior: Practical Cognition and Behavior	P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module teaches experimental approaches to understanding animal behavior by having students develop their own hypotheses and then test them using behavioral experiments. Students learn to use various analysis methods and statistical tests for data analysis.	Participation in an experiment	Report (50%), presentation (50%)	10
OEP-B03	Neuroethology: Neural Basis of Behavior and Sensory Perception	L, S*, P*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn the general principles of comparative neuroethology by performing a short experimental project in sensory and behavioral physiology. The module combines behavioral analysis and electrical derivation, stimulation and observational methods to provide insights into the experimental and analytical methods of neuroethology.	Participation in an experiment	Report (50%), seminar talk (25%), presentation (25%)	10
OEP-B04	Behavioral Ecology Theory	S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire a basic knowledge of behavioral ecology, a field that studies the evolution of adaptive behavior in an ecological context. Basic behavioral science concepts are presented and discussed in seminar format, such as the function or survival value of sexual selection or host-parasite coevolution.	None	2 seminar talks (each 50%)	5
OEP-B05	Neuroanatomy	L, S*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn experimental neuroanatomical techniques for studying the histology and connectivity of brains using tracer experiments with fluorescent and stable light reactions and histochemical analysis of neurotransmitter-related enzymes. The model focuses on the evolution of structure-function relationships in the fish nervous system.	None	Report	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B06	Palaeobiology of Invertebrates	L, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn relevant methods and various modern technical approaches (light and laser scanning microscopy, X-ray examination) for analyzing the evolution, paleoecology and paleobiology of invertebrate fossils.	Research proposal (data sheet)	Written examination	5
OEP-B07	Vertebrate Comparative Anatomy and Functional Morphology	L, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain an understanding of the vertebrate body plan and its specializations in different subgroups by dissecting selected representatives and preparing selected tissues for histology. Differences in the organization and morphology of the major organ systems are evaluated in the context of functional constraints.	None	Written examination	10
OEP-B08	Ecology of Marine Habitats	L, S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module introduces various marine habitats and provides an overview of abiotic and biotic factors that determine marine ecosystems. Students gain insights into the fragility of these habitats and a good theoretical knowledge of ecological features and constraints and the serious impact of human activities on marine systems.	Seminar talk	Written examination	5
OEP-B09/PSBE	Diversity, Systematics and Evolution of Plants	S*	OEP-M1	D: 1 sem. PRS: 2 nd sem.	Students learn about the systematics, morphology and ecology of the main groups of land plants. The focus is on the applied aspects of biodiversity research.	None	Seminar talk	3
OEP-B10/OB2	Organismic Botany 2: Vegetation and Plant Ecology	L	OEP-M2	D: 1 sem. PRS: 2 nd sem.	This module provides an overview of the distribution and composition of the major terrestrial biomes. The focus is on the influence of abiotic factors on plant communities and vegetation structure and the anthropogenic influence on terrestrial ecosystems.	None	Written examination	5
OEP-B11/PBPM0	Plant Biochemistry, Physiology and Molecular Biology	L*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module consists of a series of lectures addressing all the major topics of plant biochemistry, physiology and molecular biology and provides insights into the evolutionary significance of, among other things, abiotic and biotic environmental interactions, physiological stress, plant-microbe interactions and plant pathogens.	None	Written examination	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B12/PBIO	Systematics and Biology of Plants	P*	OEP-M1	D: 1 sem. PRS: 2 nd sem.	This module provides an introduction to the major groups and families of land plants and their systematics, morphology and ecology, including methods and terminology in descriptive and functional morphology, taxonomy and systematics.	None	Presentation (50%), report (50%)	10
OEP-B13/PAPA	Palaeobotany and Palynology	L, P*	OEP-M1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn about the fundamental role that palaeobotany and palynology play in understanding the evolution of plants. Fossil material is used to present plant evolution in the context of time, climate change and mass extinctions. The module focuses on periods of major evolutionary change and addresses the rates and timing of evolutionary change.	Reports	Written examination	5
OEP-B14/PBDC	Plant Biodiversity and Conservation	S*	OEP-M1	D: 1 sem. PRS: 3 rd sem.	This module teaches the concepts and tools of nature conservation at the national and international levels and provides an overview of international environmental agreements and organizations.	None	Seminar talk	3
OEP-B15/MP10/M60	Vertebrate Palaeontology I: Palaeobiology and Evolution of the Vertebrates	L, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students gain a general understanding of the evolutionary history, phylogeny and historical biogeography of the vertebrates and learn the theoretical background of the evolutionary history of the vertebrates. They gain detailed knowledge of the comparative anatomy and functional morphology of the tetrapod skeletal system and study vertebrate fossil deposits in the field.	Seminar talk	Written examination	5
OEP-B16	Evolution and Biodiversity of Lower Vertebrates	L, S*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides an overview of the patterns of diversity, systematics and evolution of fishes, amphibians and reptiles ("lower vertebrates") and explains the systematic and adaptive significance of morphological traits. The module teaches methods for collection-based research, important procedures for evolutionary and systematic studies and practical aspects relevant to zoos.	None	Seminar talk (50%), report (50%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B17	Evolution, Diversity, and Biology of Arthropods	L, S*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides detailed insights into the evolution, diversity and biology of arthropods in general, with special attention to spiders, millipedes, beetles and wasps. Students learn to identify arthropods and understand their evolutionary history based on comparative and phylogenetic trait analyses.	6 quizzes	2 seminar talks (each 50%)	10
OEP-B18	Speciation in Fishes: Patterns and Processes	S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with speciation theory and encourages critical discussion of alternative hypotheses on the origin of diversity in the context of fish model systems. The examples considered range from adaptive radiations in African rift lakes and the evolution of species pairs to recently discovered cases of hybrid speciation.	None	Seminar talk	2.5
OEP-B19	Patterns and Processes Shaping Biodiversity	S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides an introduction to the fields of historical biogeography and speciation of vertebrates, which are discussed in terms of species richness patterns, ecology and phylogeography. It addresses plate tectonics and distribution patterns, the biogeographical history of ecoregions, the mechanism generating diversity patterns, climate history, speciation and adaptations to ecologically extreme habitats.	None	Seminar talk (50%), report (50%)	2.5
OEP-B20	Form & Function in Birds: An Evolutionary Perspective	L, S*, PW*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with the basics of species diversity and bird classification. Students develop an understanding of avian morphology as the result of adaptation processes shaped by ecological and behavioral constraints over time. They learn about the evolutionary and functional relationships of selected bird groups by performing their own hands-on studies. The module includes a field trip to the Cologne Zoo.	None	Written examination (50%), presentation (25%), seminar talk (25%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B21/ MP13/M61	Specialization in Vertebrate Paleontology: Mammalia	L, S*, PW*	OEP-B15	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with the fauna and distribution history of the main mammalian groups. Relationships between plate tectonics and mammalian paleobiogeography. Evolution of synapsids, ecomorphology and phylogeny of Mesozoic mammals. Comparative odontological and functional morphological examinations of mammalian dentition. Studies of extensive fossil material and recent dental and skull material. Various dentition tooth categories, different tooth types as modifications of the basic tribosphenic pattern. Drawing of selected pieces.	None	Written examination (60%), presentation (30%), seminar talk (10%)	10
OEP-B22/ MP12/M63	Specialization in Vertebrate Paleontology: Dinosaurs	L, PW*, S*	OEP-B15	D: 1 sem. PRS: 2 nd or 3 rd sem.	Evolution, distribution history and extinction of dinosaurs, mammal-like reptiles and Mesozoic marine reptiles, origin and early evolution of birds. Paleobiological questions and controversies such as the evolution of warm-bloodedness and the connection between reproductive biology and evolution. Methods of paleobiological research on large reptile fossils. Histology of vertebrate fossil bones and teeth and their significance for individual development and life history. Applications to evolutionary questions, i.e. "evo-devo" (evolutionary developmental biology). Theory and practice of phylogenetic computer analysis of vertebrate fossils. Practical procedure for histological sampling and studying fossil bones and teeth.	None	Written examination (60%), presentation (30%), seminar talk (10%)	10
OEP-B23/ MP11/M62	Vertebrate Palaeontology II: Vertebrate Fossil Deposits Through Time	L, E*, FT*, S*	OEP-B15	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn about the major vertebrate fossil Lagerstätten in geological history based on collection material, field work and the scientific literature. They learn about the fauna, sedimentary environment, palaeontology and importance of certain fossil Lagerstätten for our understanding of the history of life.	Seminar talk	Written examination (50%), report (50%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B24	Plant-Animal Interactions in Deep Time: Fossil Record, Coevolution, Ecological Relationships	L*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn the evolutionary history of the morphological development of plants and animals in terms of their interactions from the Silurian to the present. The main focus is on terrestrial plants and insects, but reptiles and mammals are also included.	None	Written examination	5
OEP-B25	Research Seminar on Plant-Insect Interactions in the Fossil Record	S*, E*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This seminar covers a wide range of research topics on fossil plants, insects and their interactions in the fossil record.	None	Seminar talk	2.5
OEP-B26	Evolution of Mammals	L, S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This weekly lecture provides an overview of mammalian evolution, phylogeny and diversity. In the seminar that follows this one, selected objects are shown and discussed in order to improve understanding of the lecture content and illustrate the features.	None	Written examination	5
OEP-B27	Evolution of Mammals—Form and Function	P*, FT*	OEP-B26	D: 1 sem. PRS: 3 rd sem.	This module provides an overview of the worldwide diversity, phylogeny and evolution of mammals and a basic understanding of the evolutionary processes enabling mammals to adapt to various environments. Students learn about phylogenetic reconstruction using morphology and molecular data and comparative morphology.	Essay	Written examination (30%), report (55%), seminar talk (15%)	10
OEP-B28	Experimental Behavioral Ecology	S*, P*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides an overview of the field of behavioral ecology, with a special focus on the hypothesis-driven experimental approach. Students plan small experiments. Sticklebacks, cichlids and gammarids are available as experimental animals. Many topics are offered and analyzed using current statistical methods.	None	Report (70%), presentation (30%)	10
OEP-B29	Genomics of Behavior	S*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides background knowledge on the connection between genomics and behavioral approaches. Students gain insights into how they can be used to shed light on the genomic basis of behavior in different animal groups.	None	Seminar talk	2.5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-B30	Advanced Course in Combining Field and Lab Techniques and Methods in Organismic Biology, Evolutionary Biology or Paleobiology	P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module addresses specific topics in the laboratory and the field concerning the evolution, phylogenetics, biogeography and visualization of structures, the modeling of evolutionary processes and the relationships between structure and function. The course is aimed at teaching skills to students, collecting data in the field and analyzing it in the laboratory.	None	Report	10

The examination board may approve further elective modules and shall announce them before the beginning of the semester pursuant to § 8, para. 7.

Elective Area C (modules with fieldwork > 50%)—2 to 6 of the 15 modules are to be chosen (total a minimum of 15 and maximum of 30 CP)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-C01	Marine Biology	P*, S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module teaches various methods for studying marine biodiversity and identifying marine animals. Students are trained to work in marine environments, including underwater sampling techniques, preservation, monitoring and experiments with live marine animals.	Seminar talk, research proposal (data sheet)	Report	10
OEP-C02	Zoogeography and Ecology of Marine Organisms in Tropical Habitats (with a Field Trip to the Red Sea, Dahab, Egypt)	L, S*, P*, FT*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module provides an introduction to the abiotic conditions and fauna of tropical coral reefs at all biological levels, including the identification and qualitative assessment of the different invertebrates and vertebrates. It teaches standards for studying the social behavior of various fish species.	None	Report (50%), seminar talk (50%)	10
OEP-C03	Ecology of the Wadden Sea	L, S*, P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module introduces the ecology and diversity of a World Heritage Site. The module also provides an introduction to the meiofauna as a key component of an ecosystem and teaches how to plan and perform short field experiments. The module addresses the roles of the most important stone types and the human impact on the ecosystem.	Presentations	Report	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-C04	Biodiversity and Ecological Constraints on the Rocky Shore	L, S*, P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with the role of environmental constraints in the life history, distribution, interaction and diversity of marine organisms on the rocky shore of Brittany (France). Students learn to design, perform and statistically analyze field experiments.	Seminar talk, presentations	Report	10
OEP-C05	Fauna of the North Atlantic Coastline with a Field Trip to Roscoff, Brittany	L, S*, P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module introduces the marine macro- and megafauna of North Brittany. Students learn how to identify organisms and perform short quantitative experiments and diversity assessments at selected levels in marine habitats and for selected groups of organisms.	3 reports,	written examination (50%), presentation (50%)	10
OEP-C06	Ecology and Zoogeography of the Pannonian Region, with a Field Trip to Lake Neusiedler	L, S*, P*, FT*	OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students learn about the special ecological and biogeographical features of the Pannonian region and nearby Eastern Alps by studying the Lake Neusiedler area. Comparisons with habitats in Central Hungary help them understand the connection between central and peripheral areas.	Report	Seminar talk	10
OEP-C07	Biodiversity of the Tropics, with a Field Trip to Ecuador	S*, P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module focuses on the special characteristics of the tropics and provides deeper insights into the taxonomy and ecology of selected metazoan groups. Students are trained in methods related to field work and study adaptations in behavior and life history strategies. The causes and consequences of current environmental threats are discussed with the students.	None	Seminar talk (50%), report (50%)	10
OEP-C08	Behavioral Ecology of Hole-Nesting Passerine Birds	P*, FT*	OEP-M1, OEP-M2, OEP-B04	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students develop theoretical, organizational and practical skills to translate proximate and ultimate questions in behavioral ecology into research hypotheses, test those hypotheses in practical field experiments, analyze the results and provide answers to the questions.	None	Report	10
OEP-C09/PBEC	Vegetation Ecology (including Field Trip)	E*, S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire regional floristic and vegetation knowledge and a basic understanding of biogeography and learn techniques of floristic, vegetation and ecological field research.	None	Presentation (50%), report (50%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-C10	Palaeontology and Biology of Texas—An Integrated Field Course	S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Following a preparatory seminar, students visit important Lagerstätten and representative habitats and receive an introduction to paleontological field research during a 12-week field trip.	Seminar talk	Seminar talk (30%), report (70%)	10
OEP-C11	Mesozoic Dinosaur and Plant Ecosystems and the Marine Realm in a Transect from Southern Germany to Northern Italy	S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module focuses on Mesozoic localities with fossil plants and terrestrial and marine vertebrates north and south of the Alps. Students gain a basic understanding of paleontology and geology. The field trip includes stops at active excavations and visits to classic fossil floras and faunas in the field and in museums in Alsace, Southern Germany, Switzerland and Northern Italy.	None	Seminar talk (30%), report (70%)	10
OEP-C12	Mesozoic Dinosaur and Plant Ecosystems and the Marine Realm in England	S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire a basic understanding of paleontology and geology during a two-week practical field trip to Mesozoic fossil sites, museums and other sites of paleontological significance in England. The module includes a seminar and field course where most of the instruction takes place in the field.	None	Seminar talk (30%), report (70%)	10
OEP-C13	Integrated Field Course in Brazil	S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	Following a preparatory seminar, students visit important Lagerstätten and representative habitats and receive an introduction to paleontological field research during a 12-week field trip.	None	Seminar talk (30%), report (70%)	10
OEP-C14	Evolution and Biology of Amphibians: The Fossil Record	L, S*, PW*, FT*	None	D: 1 sem. PRS: 2 nd or 3 rd sem.	In addition to an introduction to modern Liassamphibia, the focus is on the fossil groups. Various phylogenetic hypotheses on the origin of Liassamphibia and the land invasion are also discussed. The accompanying seminar teaches various paleontological investigation methods (e.g. morphological description, drawing skulls, etc., bond histology) and prepares students for the field trip (excavation methods). The course teaches students the morphological differences between Lissamphibia and extinct amphibian groups, discusses important morphological changes (land invasion), explains problems with phylogenies and demonstrates practical paleontological field work (field trip, excavation).	5 research proposals	Seminar talk (50%), report (50%)	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OEP-C15	Biology and Paleontology of the Bighorn Basin, Wyoming, USA	S*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This seminar covers the major global climatic event in the Cenozoic period, the Paleocene–Eocene Thermal Maximum (PETM), and the subsequent biotic transition, while the 12-day field trip is a practical field course in paleontology that examines fossil and living biota in the US state of Wyoming.	None	Seminar talk (30%), report (70%)	10
OEP-C16	Advanced Field Methods in Organismic Biology, Evolutionary Biology or Paleobiology	P*, FT*	OEP-M1, OEP-M2	D: 1 sem. PRS: 2 nd or 3 rd sem.	This module deals with specific topics related to field work in paleontology, phylogenetics, biogeography, monitoring and the relationships between organisms and the environment. The course focuses on learning skills for field work. The module can include laboratory components, which must account for less than 50% of the time invested.	None	Report	10

The examination board may approve further elective modules and shall announce them before the beginning of the semester pursuant to § 8, para. 7.

Annex 4: Module structure for the consecutive master's degree program Plant Sciences

Module structure key:

- Abbreviations of course types: L = lecture, S = seminar, P = practical work, C = colloquium, FT = field trip.
- Marked with asterisk (*): Courses for which the examination board may, pursuant to § 12, para. 6, require compulsory attendance as prerequisite for participation in the module examination (field trips, language courses, lab courses, seminars, practical exercises as well as comparable courses). In these cases, compulsory attendance is an additional requirement to the other coursework listed.
- The "Course Type" column shows the type of a course within the module.
- The "Duration/Program-Related Semester" column shows the duration (D) of the module (in semesters) and assigns it to a specific program-related semester (PRS).
- The "Coursework" column shows requirements that must be met for admission to certain examinations pursuant to § 12, para. 4 or, respectively, to acquire ECTS credit points in modules without an examination. Coursework that is required for admission to certain examinations and must be repeated in case that examination is failed is marked with the letter "r" (r).
- In the "Type of Examination" column, examinations as defined by § 14, para. 6 that cannot be repeated within one semester but must rather be repeated along with the entire module or, respectively, the corresponding course are marked with the letter "r" (r).

The examination board shall make further details on individual modules, especially regarding the courses offered within or required for completion of a module, available in a module guide before the beginning of the respective semester pursuant to § 8, para. 7.

Compulsory Modules

Module Code	Module Name	Course Type	Admission Requirements	Duration/Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBPM0	Plant Biochemistry, Physiology and Molecular Biology	L		D: 1 sem. PRS: 1 st sem.	This lecture addresses all major topics related to plant biochemistry, physiology and molecular biology. Students gain solid basic knowledge of the physiological processes in plants based on the current state of research on molecular structures, reactions and processes in plant cells, tissues and organs.	None	Written examination	7
OB1	Organismic Botany 1—Plant Systematics and Biodiversity	L		D: 1 sem. PRS: 1 st sem.	This module provides an overview of plant systematics, morphology and ecology, with a focus on the systematics, diversity and evolution of flowering plants. Students also learn the basics of morphology, taxonomy and systematics.	None	Written examination	5

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
OB2/OEP-B10	Organismic Botany 2—Vegetation and Plant Ecology	L		D: 1 sem. PRS: 2 nd sem.	This module provides an overview of the distribution and composition of the major terrestrial biomes. The focus is on the influence of abiotic factors on plant communities and vegetation structure and the anthropogenic influence on terrestrial ecosystems.	None	Written examination	5
PGMA	Plant Genetics, Morphology and Cell Architecture	L		D: 1 sem. PRS: 2 nd sem.	This lecture covers the basics of plant genetics and molecular biology and the structure of cells and tissues, endosymbiotic theory, biomembranes and compartments, signaling and communication, the cell cycle and plant movement.	None	Written examination	7
Master	Master's Thesis Work		min. 60 CP	D: 1 sem. PRS: 4 th sem.	Students independently plan and evaluate an experiment and prepare a research paper		Master's thesis	30

Elective Modules

At least 3 modules must be chosen from each of Elective Area B and Elective Area C, for a total of at least 39 CP. At least 27 additional credit points must be obtained from modules in the other elective areas (D, E or further modules from Elective Areas B and C).

Elective Area B (theoretical elective modules)—a minimum of 3 and maximum of 5 modules are to be chosen (9 to 15 ECTS CP)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBPM1	Plant Molecular Physiology & Technology	S*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students gain an in-depth understanding of plant development and assembly processes, their regulation by hormones and environmental factors and the biotechnological approach to manipulating them.	None	Seminar talk	3
PBPM2	Transgenic Plant Research	S*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students search, summarize, present and discuss current literature on new research in plant molecular biology concerning the production and/or analysis of genetically modified plants in applied or basic research.	None	Seminar talk	3

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBPM3	Ecophysiology	S*		D: 1 sem. PRS: 1 st or 3 rd sem.	Various aspects of plant-environment interactions are covered. These include the effects of abiotic and biotic environmental factors on plants and the corresponding reactions by plants from the molecular to the organismal level. Students gain a basic understanding of plant-environment interactions and how plants react to various environmental factors.	None	Seminar talk	3
PLSM	Plant Secondary Metabolism	S*		D: 1 sem. PRS: 3 rd sem.	Students gain an overview of the secondary metabolites produced by plants. The general and special functions of certain secondary metabolites are discussed.		Seminar talk	3
PBDC/OEP-B14	Plant Biodiversity and Conservation	S*		D: 1 sem. PRS: 1 st or 3 rd sem.	This module teaches the concepts and tools of nature conservation at the national and international levels and provides an overview of international environmental agreements and organizations.	None	Seminar talk	3
PSBE/OEP-B09	Diversity, Systematics and Evolution of Plants	S*	OB1	D: 1 sem. PRS: 2 nd sem.	Students learn about the systematics, morphology and ecology of the main groups of land plants. The focus is on the applied aspects of biodiversity research.	None	Seminar talk	3
PLDE	Plant Development and Communication	S*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students gain an overview of plant development and morphogenesis with a focus on root development.	None	Seminar talk	3
PLOS	Plant Organelles—Structure and Function	S*		D: 1 sem. PRS: 2 nd sem.	Students acquire advanced knowledge of the structure and function of plant organelles. They work together and individually to gain an understanding of the role that organelles play in different tissues and in relation to various cellular processes. They also further develop their ability to present and discuss scientific issues in English in a comprehensible manner, both in written and oral form.	None	Seminar talk	3
PMBG	Plant Molecular Biology and Genetics	S*		D: 1 sem. PRS: 2 nd sem.	Plant molecular biology, genetics, biochemistry, biotechnology	None	Seminar talk	3
PMEP	Plant Molecular Evolution and Phylogeny	L*, S*		D: 1 sem. PRS: 2 nd or 4 th sem.	Bioinformatics methods and results of current research on molecular evolution and phylogenetics with a focus on early land plants and endosymbiotic theory.	Presentation	Written examination (60%), seminar talk (40%)	5

Elective Area C (practical elective modules)—a minimum of 3 modules are to be chosen (minimum 30 ECTS CP)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PCE	Physiological and Chemical Ecology	P*	PBPM0	D: 1 sem. PRS: 1 st or 3 rd sem.	Purification and isolation of plant natural products, chromatography techniques, gene expression studies, microscopy, photometry, quantitative transport physiology. Use of sophisticated molecular biological techniques in plant physiology. Experience in independent experimental planning, performance and record keeping. Critical data interpretation and presentation.	None	Poster (50%), report (50%)	10
PMGL	Plant Molecular Genetics Lab	P*	PBPM0	D: 1 sem. PRS: 2 nd sem.	Experimental laboratory routines and basic bioinformatics methods for the production and molecular analysis of model transgenic plants, in particular for the moss <i>Physcomitrella patens</i> and the molecular genetics of mitochondria and chloroplasts.	Research proposal	Written examination (50%), presentation (50%)	10
PLCS	Plant Cellular Signaling	P*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students gain insights into plant signaling with a special focus on calcium-mediated signaling pathways in the stress response. The course presents possible strategies and experimental approaches that allow certain research questions to be addressed. They learn to design and perform appropriate experiments and interpret the results obtained.	None	Presentation (50%), report (50%)	10
PPCB	Plant Physiology and Cell Biology	P*	PBPM0	D: 1 sem. PRS: 1 st or 3 rd sem.	Plant molecular biology, cells, callus, protoplasts, plant transformation, reporter constructs, PCR	None	Presentation (50%), report (50%)	10
MBRE/OEP-A18	Modern Biodiversity Research: From Population Genetics to Phylogenomics	P*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students gain an in-depth understanding of molecular evolutionary processes based on changes in DNA sequences. The focus is on using this information for phylogenetic and evolutionary analyses.	None	Presentation (30%), report (70%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBCO1/OEP-A15	GIS for Plant Biogeography & Conservation	P*		D: 1 sem. PRS: 1 st or 3 rd sem.	This module teaches students how to design and perform analyses in the fields of macroecology, biogeography and nature conservation using geographical information systems (GIS). The module combines an introduction to mapping and spatial data analysis with theory and exercises from the fields of macroecology and biogeography. A special focus is placed on analyses of the impact of global environmental change on biodiversity.	None	Presentation (60%), report (40%)	5
PBCO2/OEP-A16	Biodiversity Informatics: Data Analyses for Ecology and Biogeography	P*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students learn to design and perform analyses in the fields of (macro)ecology and biogeography using mainly code-based analysis software such as R or Julia. The module provides an overview of the methods commonly used to analyze and model data in the fields of ecology (incl. macroecology) and biogeography.	None	Presentation (60%), report (40%)	5
MCPB	Molecular Cell Physiology & Biotechnology	P*	PBPM0	D: 1 sem. PRS: 2 nd sem.	Plant molecular biology, biochemical analytics: DC, HPLC, GC-MS	None	Presentation (50%), report (50%)	10
PBB	Protein Biochemistry and Biotechnology	P*		D: 1 sem. PRS: 1 st , 2 nd , 3 rd or 4 th sem.	Students learn to describe and explain basic concepts and methods of protein biochemistry and apply the methodological knowledge they acquire in practice. They gain an understanding of the individual process steps, from expression and purification of a protein to the structure and kinetic characteristics and can perform the individual steps independently. Students can accurately document, evaluate and assess the experiments performed.	None	Written examination (50%), presentation (20%), report (30%)	10
MCPB	Molecular Cell Physiology & Biotechnology	P*	PBPM0	D: 1 sem. PRS: 2 nd sem.	Plant molecular biology, biochemical analytics: DC, HPLC, GC-MS	None	Presentation (50%), report (50%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
TPP	Transport Physiology	P*	PBPM0	D: 1 sem. PRS: 2 nd or 4 th sem.	Interactions between plants and their environment are studied experimentally from the molecular to the organismic level. This includes studies of water and salt stress, the effects of xenobiotics on plants, interactions with microorganisms and secondary plant metabolism. Modern methods of molecular plant physiology and ecology are introduced. Students learn different methods of transport physiology, gain experience in planning and performing experiments independently and learn how to present their own experimental results.	Statistical and graphical analysis and presentation of own experimental results	Written examination	10
PMSA	Plant Morphology and Structural Adaptation	P*		D: 1 sem. PRS: 1 st or 3 rd sem.	Students gain insights into the rich world of morphological and cellular adaptations to different lifestyles and environmental conditions. They mainly use light microscopic methods in their studies. They receive guidance in selecting and analyzing suitable plant material for a specific research question.	None	Presentation (50%), report (50%)	10
PLDE	Plant Development and Communication	P*		D: 1 sem. PRS: 2 nd sem.	Students gain insights into the complex interactions between the cytoskeleton and vesicle transport, polarity and plant development, signaling molecules and the regulation of morphogenesis, cell, tissue and organ development. The basic processes for plant development and communication are presented and discussed using shoots and root tips, pollen and root hairs as examples.	None	Presentation (50%), report (50%)	10
PEPL	Plant Evolution and Phylogenetics	P*		D: 1 sem. PRS: 2 nd or 4 th sem.	Basic methods of molecular cloning of DNA and cDNA, bioinformatic sequence analysis and methods of molecular phylogenetic tree construction with respect to the special molecular characteristics of plant mitochondria and chloroplasts and a focus on early branching land plant lineages.	Research proposal	Written examination (50%), presentation (50%)	10

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBIO/OEP-B12	Systematics and Biology of Seed Plants	P*	OB1	D: 1 sem. PRS: 2 nd or 4 th sem.	This module provides an introduction to the major groups and families of land plants and their systematics, morphology and ecology, including methods and terminology in descriptive and functional morphology, taxonomy and systematics.	None	Presentation (50%), report (50%)	10

Elective Area D (optional electives)

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
PBEC/OEP-C09	Vegetation Ecology (incl. Field Trip)	FT*, S*, P*	OB1	D: 1 sem. PRS: 2 nd or 3 rd sem.	Students acquire regional floristic and vegetation knowledge and a basic understanding of biogeography and learn techniques of floristic, vegetation and ecological field research.	None	Presentation (50%), report (50%)	10
PAPA	Paleobotany & Palynology	L*, P*		D: 1 sem. PRS: 2 nd or 4 th sem.	Students learn about the fundamental role that palaeobotany and palynology play in understanding the evolution of plants. Fossil material is used to present plant evolution in the context of time, climate change and mass extinctions. The module focuses on periods of major evolutionary change and addresses the rates and timing of evolutionary change.	None	Written examination (50%), report (50%)	5
PHPR (MIB9)	Phototrophic Prokaryotes	P*, L, S*	at least 3 rd semester	D: 1 sem. PRS: 3 rd sem.	Participants learn that phototrophy is not just the most important characteristic of plants, but also of many bacteria that play prominent roles as primary producers at both anoxic and oxic sites. The module allows students to understand the versatility of phototrophic organisms. It also provides the skills needed to develop concepts about how complex oxygen-producing photosynthesis could have evolved from anoxic origins.	Seminar talk	Written examination (50%), report (50%)	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
GAPB (NPW-048)	Genome Analysis in Plant Breeding	L*, P*		D: 1 sem. PRS: 3 rd sem.	<p>After completing the module, students will be able to ...</p> <ul style="list-style-type: none"> - understand and apply DNA marker techniques - understand and apply high throughput genotyping - understand and apply genomic analysis using next generation sequencing methods - understand and apply genetic linkage analysis and linkage map development - understand and apply trait analysis using gene association analysis (QTL mapping, GWAS) - understand and apply gene mapping in connection with qualitative and quantitative traits - understand and apply the isolation of genes and their allelic diversity - understand and apply marker-assisted selection and the transfer of favorable alleles into plant varieties - understand and apply molecular breeding and the development of improved plant varieties 	None	Written examination	6
MAGF (NPW-042)	Molecular Analysis of Gene Function	P*	PBPMO or Crop Physiology; at least one practical lab course	D: 1 sem. PRS: 3 rd sem.	<p>After completing the module, students will be able to ...</p> <ul style="list-style-type: none"> - describe and analyze the phenotype of wild-type plants and mutants - extract and test genomic DNA for mutations - develop and test hypotheses to explain gene function - use chemical probes and genetically coded probes for live cell imaging - apply statistical analysis to results and test hypotheses - demonstrate improved research writing skills - apply experimental forward and reverse genetic approaches 	Seminar talk	Presentation (50%), report (50%)	6

Module Code	Module Name	Course Type	Admission Requirements	Duration/ Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
CRPS	Colloquium Reports in the Plant Sciences	C*		D: 2 sem. PRS: 1 st , 2 nd or 3 rd sem.	Students take part in presentations of current research papers by invited speakers. They learn how to follow a current research presentation, become familiar with different styles of presentation to improve their own, learn to formulate questions and contributions for discussions and summarize a research topic area in the abstract style used by scientific publications.	Participation in 8 botanical colloquia	Term paper	5

Elective Area E (optional electives)—FREE1, FREE3 and FREE4 modules can be chosen up to a maximum of 10 ECTS CP each, FREE2 modules up to a maximum of 20 ECTS CP. At most one FREE2 internship can be done at an institution that is not involved in the degree program (e.g. Max Planck Institute). § 30 remains unaffected.

Module Code	Module Name	Course Type	Admission Requirements	Duration/Program-Related Semester	Subject (Content) of Examination and Qualification Objective	Coursework	Type of Examination	ECTS CP
FREE1	FREE1—General Plant Sciences ¹ .	L/P/S, as indicated in the degree program concerned.		PRS: 1 st , 2 nd or 3 rd sem.	This module gives students the opportunity to acquire in-depth knowledge in the field of botany in a plant sciences module. Students acquire theoretical knowledge (literature research, data analysis, record keeping, presentation techniques).	As indicated in the degree program concerned.		1–10, as indicated in the degree program concerned.
FREE2	FREE2—Internship in Plant Sciences ² .	P*		D: 1 sem. PRS: 1 st , 2 nd or 3 rd sem.	This module gives students the opportunity to perform hands-on work on a current plant science research project in a plant science research group. Students acquire practical skills (planning and performing lab experiments, including data analysis).		Report	3–10
FREE3	FREE3—Related Natural Sciences ³	L/P/S, as indicated in the degree program concerned.		PRS: 1 st , 2 nd or 3 rd sem.	This module gives students the opportunity to acquire in-depth knowledge in related natural science modules (see footnote). Students acquire theoretical knowledge (literature research, data analysis, record keeping, presentation techniques) or practical skills (planning and performing lab experiments).	As indicated in the degree program concerned.		1–10, as indicated in the degree program concerned.
FREE4	FREE4—Related Academic Studies ⁴ .	L/P/S, as indicated in the degree program concerned.		PRS: 1 st , 2 nd or 3 rd sem.	This module gives students the opportunity to acquire knowledge in related academic areas (see footnote). Students acquire theoretical knowledge (literature research, data analysis, record keeping, presentation techniques).	As indicated in the degree program concerned.		1–10, as indicated in the degree program concerned.

The examination board may approve other elective modules. The examination board shall announce the approved elective modules at the beginning of the semester pursuant to § 8, para. 7.

¹Any plant sciences module from an accredited master's degree program in the European Higher Education Area can be chosen as a FREE1 elective module, e.g. modules from the Crop Science master's degree program at the University of Bonn.

²Individually agreed research projects and lab work in research groups working in the plant sciences at universities or research institutes (e.g. Max Planck Institute) in the European Higher Education Area can be chosen as FREE2 elective modules. As a rule, the duration is six weeks for 10 ECTS CP.

³Modules in related sciences (e.g. biochemistry, pharmacy, geosciences, biotechnology, agriculture) that are offered in an accredited master's degree program in the European Higher Education Area and have a connection to the plant sciences (e.g. phytochemistry) can be chosen as FREE3 elective modules.

⁴Suitable modules (those with a connection to the plant sciences, related subject) from accredited master's degree programs outside the natural sciences (e.g. law, economics) in the European Higher Education Area can be chosen as FREE4 elective modules (e.g. patent law).

Annex 5: Regulations for admission to courses

If admission to a course, due to its nature, purpose or to other reasons, needs to be limited and the number of registrations exceeds the defined capacities, it is handled as follows:

Applicants shall be admitted in the following order:

- **Group 1:**
Students who are enrolled at the University of Bonn, for whom, according to the curriculum, participation in this course is mandatory and who are in the same or a higher program-related semester as/than the one specified for participation in the curriculum, provided they
 - a. were kept from registering for the course due to a delay in the first semester, or
 - b. were not selected in a random selection procedure at least once in the past;
- **Group 2:**
Students who are enrolled at the University of Bonn and who are in the same or a higher program-related semester as/than the one specified for participation in the curriculum, and who do not belong to Group 1;
- **Group 3:**
All other students enrolled at the University of Bonn who are eligible for participation in this course pursuant to the curriculum;
- **Group 4:**
All other students.

This does not affect further admission requirements. Within the groups—except Group 4—students who have collected the largest number of credit points for the chosen degree program or for another degree program at the University of Bonn that imports modules from the chosen degree program shall have priority. Remaining places are allocated by drawing lots.

Annex 6: Procedure in accordance with § 5, para. 6 of these Examination Regulations for the aptitude test for foreign applicants to the consecutive master's degree program Molecular Cell Biology who are not given equivalent status to Germans by or based on international treaties

I. General principles

- (1) The admission requirements in § 5 of the Examination Regulations must be satisfied for admission to the consecutive master's degree program Molecular Cell Biology. Under § 5, para. 6 of the Examination Regulations, foreign applicants who are not given equivalent status to Germans by or based on international treaties must pass a special aptitude test for university studies.
- (2) This Annex sets down the provisions governing the aptitude test for university studies specified in para. 1.
- (3) The objective of the procedure is to determine whether applicants have the aptitude necessary to be expected to successfully graduate from the degree program.
- (4) §§ 6 (Recognition of and granting credit for academic achievements), 8 (Examination board), 9 (Examiners and assistant examiners), 28 (Access to examination records) and 29 (Invalidity of the master's examination and revocation of the master's degree) of these Examination Regulations shall apply accordingly.

II. Eligibility and application procedure/admission to the examination procedure

- (1) Foreign applicants who satisfy the other admission requirements in § 5 of the Examination Regulations and who are not given equivalent status to Germans by or based on international treaties can participate in the examination procedure for the aptitude test for university studies specified in Part I, para. 3. Sentence 2 of para. 5 remains unaffected.
- (2) Applications for admission to the examination procedure must be submitted electronically in German or English using the application forms provided by the examination board. Admission takes place each winter semester. The application deadline is March 31. The time of electronic receipt by the University of Bonn determines whether the application deadline has been met. The application deadline and issuing of the notices in Part VI shall be coordinated with the enrollment deadline.
- (3) The following documents shall be included in German or English in electronic form with the application:
 1. Proof of formal qualification in accordance with § 5, para. 1 to 4 of the Examination Regulations or a provisional certificate in accordance with para. 5, sentence 2;
 2. A completed admission application form;
 3. A curriculum vitae with a detailed description of prior education;
 4. Proof of English language proficiency in accordance with § 5, para. 5 of the Examination Regulations.
- (4) The chairperson of the examination board established in accordance with § 8 of the Examination Regulations shall make the decision on the application for admission to the examination procedure.
- (5) Admission shall be rejected if the application is incomplete. If the documents specified in para. 3 are not yet available at the time the application is submitted, a corresponding certificate from the university concerned and a list of the subjects and modules completed and their grades shall be sufficient for the application. The applicant must submit formal proof immediately upon receipt.

III. Performing the examination procedure

- (1) The examination board formed in accordance with § 8 of the Examination Regulations is responsible for organizing and carrying out the examination procedure. The examination board shall hold discussions and make decisions in closed meetings. It shall appoint a committee to perform a preliminary examination based on the application documents to determine whether the applicant has the knowledge in the fields specified in Part IV, para. 1 of this annex that is required to successfully complete the master's degree program. The committee shall consist of a chairperson and at least two other members from the group of professors in the Molecular Cell Biology degree program. Decisions shall be made by simple majority. In the event of a tie vote, the chairperson's vote shall be the deciding vote.
- (2) The examination board appoints the examiners for the examination procedure. § 9 of the Examination Regulations applies accordingly.

IV. Examination procedure

- (1) The application documents will be checked to determine the level of education achieved in the first degree in the subjects listed below. Particular attention will be given to whether the applicant has the knowledge in the following areas that are required for successfully completing the consecutive master's degree program Molecular Cell Biology:

- Biochemistry
- Molecular biology
- Microbiology
- Cell biology

The standard used shall be the level of knowledge reached in the Biology bachelor's degree program at the University of Bonn at the end of the 5th semester. The committee appointed by the examination board decides whether the aptitude test for university studies must be taken in order to assess the qualifications of the applicant based on the criteria above.

- (2) Applicants who completed their bachelor's studies in the Biology degree program or in a related or comparable degree program at another institution of higher education within the scope of the German Basic Law (*Grundgesetz*) or at an institution of higher education in a member state of the European Union or a state that has ratified the Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Lisbon Recognition Convention) have already proven their aptitude for university studies and are exempt from the test.
- (3) Written examinations shall be a maximum of three hours in length. Oral examinations shall be a maximum of one hour in length. Applicants who satisfy the admission requirements for the aptitude test for university studies in Part II shall be notified in writing of the type of examination and examination date. Examinations shall take place in English.

V. Grading of examinations

- (1) A point score is assigned for the written or oral examination. The highest possible score is 100 points. The assessment is considered passed if a score of at least 50 points is achieved.
- (2) Applicants who try to influence the outcome of a written examination through deception or the use of inadmissible auxiliary means shall receive an overall score of "0" (zero) points on the written examination. If a proctor determines that such deception has taken place, the applicant can request that the examination board review the decision.
- (3) Written examinations shall be graded by two examiners. The two examiners assign separate point scores for the examination. The overall score for the paper is calculated as the arithmetic average of the individual scores assigned by the two examiners.
- (4) The oral examination shall be conducted by several examiners or a single examiner as an individual or group interview in the presence of a competent assistant examiner (§ 9, para. 1 of the Examination Regulations). If the examination is only conducted by a single examiner, the examiner shall hear the assistant examiner in private prior to setting a grade.
- (5) Otherwise, § 12, para. 7 of the Examination Regulations shall apply accordingly.

VI. Notification of the results and repetition of the examination procedure

- (1) Candidates shall be informed of their results on the oral examination immediately following the examination. The examination board shall also notify the applicant in writing of the results of the examination. If the notice indicates a negative decision, it must include information on legal remedies. The reasons for the negative decision must be included.
- (2) Applicants who do not pass the examination procedure may repeat the examination on the date in the following semester at the earliest; a new application is required. A second repetition is not possible.

VII. Students who change the location of their studies

For students who change the location of their studies and were previously enrolled in a master's degree program in molecular cell biology or a comparable degree program at another institution of higher education, the examination board shall assess their individual qualifications, including an examination procedure if one was performed. If the examination board decides that the degree program and examination procedure are equivalent, the applicant will be exempt from participating in the examination procedure at the University of Bonn.

Annex 7: Procedure in accordance with § 5, para. 6 of these Examination Regulations for the aptitude test for foreign applicants to the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) who are not given equivalent status to Germans by or based on international treaties

I. General principles

- (1) The admission requirements in § 5 of the Examination Regulations must be satisfied for admission to the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology). Under § 5, para. 6 of the Examination Regulations, foreign applicants who are not given equivalent status to Germans by or based on international treaties must pass a special aptitude test for university studies.
- (2) This annex sets down the provisions governing the aptitude test for university studies specified in para. 1.
- (3) The objective of the procedure is to determine whether applicants have the aptitude necessary to be expected to successfully graduate from the degree program.
- (4) §§ 6 (Recognition of and granting credit for academic achievements), 8 (Examination board), 9 (Examiners and assistant examiners), 28 (Access to examination records) and 29 (Invalidity of the master's examination and revocation of the master's degree) of these Examination Regulations shall apply accordingly.

II. Eligibility and application procedure/admission to the examination procedure

- (1) Foreign applicants who satisfy the other admission requirements in § 5 of the Examination Regulations and who are not given equivalent status to Germans by or based on international treaties can participate in the examination procedure for the aptitude test for university studies specified in Part I, para. 3. Sentence 2 of para. 5 remains unaffected.
- (2) Applications for admission to the examination procedure must be submitted electronically in German or English using the application forms provided by the examination board. Admission takes place each winter semester. The application deadline is April 15. The time of electronic receipt by the University of Bonn determines whether the application deadline has been met. The application deadline and issuing of the notices in Part VI shall be coordinated with the enrollment deadline.
- (3) The following documents shall be included in German or English in electronic form with the application:
 1. Proof of formal qualification in accordance with § 5, para. 1–4 of the Examination Regulations or a provisional certificate in accordance with para. 5, sentence 2;
 2. A completed admission application form;
 3. A curriculum vitae with a detailed description of prior education;
 4. Proof of English language proficiency in accordance with § 5, para. 5 of the Examination Regulations.
- (4) The chairperson of the examination board established in accordance with § 8 of the Examination Regulations shall make the decision on the application for admission to the examination procedure.
- (5) Admission shall be rejected if the application is incomplete. If the documents specified in para. 3 are not yet available at the time the application is submitted, a corresponding certificate from the university concerned and a list of the subjects and modules completed and their grades shall be sufficient for the application. The applicant must submit formal proof immediately upon receipt.

III. Performing the examination procedure

- (1) The examination board formed in accordance with § 8 of the Examination Regulations is responsible for organizing and carrying out the examination procedure. The examination board shall hold discussions and make decisions in closed meetings. It shall appoint a committee to perform a preliminary examination based on the application documents to determine whether the applicant has the knowledge in the fields specified in Part IV para. 1 of this annex that is required to successfully complete the master's degree program. The committee shall consist of a chairperson and at least two other members from the group of professors in the Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology) degree program. Decisions shall be made by simple majority. In the event of a tie vote, the chairperson's vote shall be the deciding vote.
- (2) The examination board appoints the examiners for the examination procedure. § 9 of the Examination Regulations applies accordingly.

IV. Examination procedure

- (1) The application documents will be checked to determine the level of education achieved in the first degree in the subjects listed below. Particular attention will be given to whether the applicant has the knowledge in the following areas that are required for successfully completing the consecutive master's degree program Organismic Biology, Evolutionary Biology and Palaeobiology (OEP Biology):

- Evolutionary biology
- Zoology
- Botany
- Paleontology

The standard used shall be the level of knowledge reached in the Biology bachelor's degree program at the University of Bonn at the end of the 5th semester. The committee appointed by the examination board decides whether the aptitude test for university studies must be taken in order to assess the qualifications of the applicant based on the criteria above.

- (2) Applicants who completed their bachelor's studies in the Biology degree program or in a related or comparable degree program at another institution of higher education within the scope of the German Basic Law (*Grundgesetz*) or at an institution of higher education in a Member State of the European Union or a state that has ratified the Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Lisbon Recognition Convention) have already proven their aptitude for university studies and are exempt from the test.

- (3) Written examinations shall be a maximum of three hours in length. Oral examinations shall be a maximum of one hour in length. Applicants who satisfy the admission requirements for the aptitude test for university studies in Part II shall be notified in writing of the type of examination and examination date. Examinations shall take place in English.

V. Grading of examinations

- (1) A point score is assigned for the written or oral examination. The highest possible score is 100 points. The assessment is considered passed if a score of at least 50 points is achieved.
- (2) Applicants who try to influence the outcome of a written examination through deception or the use of inadmissible auxiliary means shall receive an overall score of "0" (zero) points on the written examination. If

a proctor determines that such deception has taken place, the applicant can request that the examination board review the decision.

(3) Written examinations shall be graded by two examiners. The two examiners assign separate point scores for the examination. The overall score for the paper is calculated as the arithmetic average of the individual scores assigned by the two examiners.

(4) The oral examination shall be conducted by several examiners or a single examiner as an individual or group interview in the presence of a competent assistant examiner (§ 9, para. 1 of the Examination Regulations). If the examination is only conducted by a single examiner, the examiner shall hear the assistant examiner in private prior to setting a grade.

(5) Otherwise, § 12, para. 7 of the Examination Regulations shall apply accordingly.

VI. Notification of the results and repetition of the examination procedure

(1) Candidates shall be informed of their results on the oral examination immediately following the examination. The examination board shall also notify the applicant in writing of the results of the examination. If the notice indicates a negative decision, it must include information on legal remedies. The reasons for the negative decision must be included.

(2) Applicants who do not pass the examination procedure may repeat the examination on the date in the following semester at the earliest; a new application is required.st A second repetition is not possible.

VII. Students who change the location of their studies

For students who change the location of their studies and were previously enrolled in a master's degree program in organismic biology or a comparable degree program at another institution of higher education, the examination board shall assess their individual qualifications, including an examination procedure if one was performed. If the examination board decides that the degree program and examination procedure are equivalent, the applicant will be exempt from participating in the examination procedure at the University of Bonn.