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Technische Universität Dresden  
Faculty of Biology

## **Study Regulations for the consecutive Master's degree program Molecular Biosciences and Productive Biosystems**

as of October 10, 2021  
(translated version)

On the basis of § 36 para. 1 of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony (*Sächsisches Hochschulfreiheitsgesetz*) in the version published on January 15, 2013 (SächsGVBl. p. 3), Technische Universität Dresden issues the following Study Regulations as statutes.

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## **§ 1**

### **Scope of application**

On the basis of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony (SächsHSFG) and the examination regulations, these study regulations stipulate the objectives, content, structure and organization of the consecutive Master's program Molecular Biosciences and Productive Biosystems at Technische Universität Dresden.

## **§ 2**

### **Objectives of the degree program**

(1) Students expertly handle the depth and breadth of molecular biology, with a systemic focus on microorganisms, fungi, and plants. They recognize the professional interdependencies and have deepened their professional and interdisciplinary knowledge as well as practical skills and abilities in selected fields. They are able to investigate scientific questions and are able to plan and conduct experiments, and are committed to the rules of good scientific practice. Modern methodological skills enable them to work on complex applied biology issues in a scientifically appropriate, well-founded and critical manner. Across disciplines and organisms, they are familiar in particular with the applied aspects of the technical use of biological systems. Students are also able to acquire knowledge independently through research and experimentation, critically evaluate and question their own and others' results and findings against the background of comparable work, present them in a scientifically correct way and discuss them in a differentiated manner. In addition, they are able to solve tasks both independently and as part of an interdisciplinary team. Students are empowered to use their knowledge, understanding, and problem-solving skills in new and unfamiliar situations and to work in a team. Students possess key skills relevant to professional life, such as communication skills and teamwork, presentation skills, critical self-reflection, work organization, time management, and project planning. Moreover, they are able to make responsible judgments and act responsibly, and are able to critically address issues relevant to society.

(2) Graduates will be qualified to begin their careers with their in-depth specialist knowledge and practical skills required for professional life combined with their methodical, personal, and social competencies. They are able to nurture interdisciplinary relationships and are qualified to work in highly specialized positions, whether in teaching or research institutions, industry and authorities as well as for other activities in companies and institutions with a biological-biotechnological, (bio-)chemical or pharmaceutical focus. They will also be well prepared to undergo further scientific qualification, in national and international graduate programs.

## **§ 3**

### **Admission requirements**

(1) To be admitted to the degree program, candidates must have completed a first vocational university degree recognized in Germany or a qualification from a state or state-approved vocational academy in a scientific field such as biology, biotechnology, or life sciences or in a closely related degree program such as biochemistry or biophysics. Moreover, fundamental knowledge of genetics, molecular biology, and microbiology, as well as sufficient motivation for the degree program are required. Proof of this particular suitability is provided by an aptitude assessment in accordance with the aptitude assessment regulations for Molecular Biosciences and Productive Biosystems.

(2) Furthermore, this degree program also requires English language proficiency at the advanced level of B2 of the Common European Framework of Reference for Languages (CEFR). Para. 2 sentence 3 shall apply accordingly.

#### **§ 4**

#### **Start and duration of the degree program**

(1) The program can be started each summer semester.

(2) The standard period of study is four semesters and includes on-site attendance, self-study, supervised practice periods, and the Master's examination.

#### **§ 5**

#### **Teaching and learning methods**

(1) The curriculum is structured in modules. In the individual modules, the course content is taught, consolidated and deepened through lectures, seminars, exercises, practical training, tutorials, student working groups, projects, research colloquia, field trips, language courses, and self-study.

(2) The individual teaching and learning forms according to para. 1 sentence 2 are defined as follows:

1. Lectures introduce the subject areas of the modules, address the central themes and structures of the subject area in a coherent presentation, and provide an overview of the current state of research.
2. Seminars allow for the application of the subject matter in exemplary sub-areas as well as the development of methodical, analytical and communicative competences. Students are enabled to familiarize themselves under supervision in a selected area of interest on the basis of specialist literature or other material, to report on the results of their work, to discuss them within the group and / or to present them in writing.
3. Exercises serve to apply the subject matter in exemplary sub-areas.
4. Practical training serve the application of the subject matter taught and the acquisition of further practical skills, they support the combination of theory and practice, and explore specialist topics while considering interdisciplinary research questions.
5. Tutorials are courses designed to provide support for students. In tutorials, students reflect on issues, approaches to solutions, and results of their self-study with a student tutor and receive individual feedback.
6. Student working groups are courses designed for students to introduce and immerse themselves in the methods of scientific work. They encourage holistic and independent learning in a team and foster creativity.
7. Projects support the combination of theory and practice and explore particular topics while including interdisciplinary issues of the professional field. Projects allow students to apply and deepen their methodological and social skills in particular.
8. Research colloquia serve as a forum for lecturers and students to exchange ideas about project work, study results and other research work.
9. Field trips are guided by scientists and take students to places of learning outside the university, enabling them to thoroughly explore relevant subject-specific issues in nature and society.

10. Language courses convey and hone knowledge, skills and abilities in a foreign language. They foster the development of communication and intercultural competences in academic and professional contexts, as well as in everyday situations.
11. Through self-study, students independently consolidate and deepen their knowledge of the course content.

## **§ 6**

### **Structure and organization of the degree program**

(1) The program is organized in modules. The curriculum is divided into three semesters. The fourth semester is dedicated to the preparation of the Master's thesis including the colloquium. The third semester is particularly suitable for a temporary stay at another university (mobility window).

(2) The degree program comprises ten modules, with the "Systems Biology and Genomics", "General Qualifications", "Productive Pathways" as well as "Application Technologies" being designed with elective compulsory content, enabling the student to choose their focus. The catalogs for the module descriptions with elective-compulsory components will be announced at the beginning of each semester as is customary at the faculty.

(3) Qualification objectives, contents, teaching and learning methods included, requirements, applicability, frequency, workload, and duration of the individual modules are listed in the module descriptions (Annex 1).

(4) The courses are held in English or, if indicated by the module descriptions, in German. If, according to the module description, a module primarily serves to acquire foreign language qualifications, the respective foreign language can also be the language of instruction.

(5) The appropriate allocation of the modules to the individual semester, the observance of which makes it possible to complete the program within the standard period of study, as well as the type and scope of the respective courses included, and the number and standard time of the required study achievements and examined assessments are defined in the study schedule attached (Annex 2).

## **§ 7**

### **Content of the degree program**

(1) Molecular Biosciences and Productive Biosystems is a research-oriented Master's degree program.

(2) The contents of the degree program include the theory and practice of molecular biotechnology in the context of microbes, fungi and plants, as well as aspects of the application of these systems for the production of active substances and chemicals. Here, the focus is particularly on the progressive development of bioeconomy. In addition, the program includes molecular principles of bacterial regulation at the level of transcription and translation initiation, signal transduction, enzymology, sequence-based analyses of microbial, fungal, or plant proteomic or genomic data, bioinformatics tools for sequence analysis, and metabolic principles and mechanisms of natural and artificial metabolism and biocatalysis, including their effects. In addition, students deepen their practical knowledge and skills in lab rotations under supervision

and are familiar with methodological approaches as well as technological backgrounds of the use of organismic and molecular biological systems. General qualifications as well as interdisciplinary content or languages are also part of the program.

## **§ 8 Credit points**

(1) ECTS credit points document the average workload of the students and their individual study progress. One credit point corresponds to a 30-hour workload. Normally, 60 credit points are awarded per academic year, i.e. 30 credit points per semester. The total workload for the program corresponds to 120 credit points and comprises the teaching and learning methods according to type and scope stipulated in the module descriptions, the study achievements and examined assessments, the Master's thesis, and the colloquium.

(2) The module descriptions indicate the number of credit points that can be earned by each module. Credit points are awarded upon passing the module examination. § 29 of the examination regulations shall remain unaffected.

## **§ 9 Academic advisory and counseling service**

(1) General advice will be provided by the Central Student Information and Counseling Service at TU Dresden. It covers questions regarding study options, enrollment modalities and general student affairs. Subject-specific advice during studies will be provided by the Academic Advisory Service of the Faculty of Biology. This subject-specific advisory service assists students with regard to the design of their studies.

(2) At the beginning of the third semester, each student who has not yet provided proof of academic performance shall make use of the subject-specific advisory services.

## **§ 10 Changes to module descriptions**

(1) In order to amend to changed conditions, the module descriptions may be changed in a simplified procedure in order to optimize study organization, with the exemption of the fields "Module name", "Qualification objectives", "Contents", "Teaching and learning methods", "Requirements for earning credit points", "Credit points and grades" as well as "Module duration".

(2) In a simplified procedure, the Faculty Board will adopt the amendments to the module descriptions upon proposal of the Academic Affairs Committee. The amendments shall be published as is customary at the faculty.

## **§ 11 Entry into force and publication**

(1) These Study Regulations shall enter into force on the day following their publication in the Official Announcements of TU Dresden.

(2) They apply to all students enrolled in the Master's program in Molecular Biosciences and Productive Biosystems in the 2022 summer semester or later.

Issued based on the resolution of the Faculty Board of the Faculty of Biology as of January 27, 2021, and the approval of the University Executive Board as of September 7, 2021.

Dresden, as of October 10, 2021

The Rector  
of Technische Universität Dresden

Prof. Dr. Ursula M. Staudinger

## Annex 1: Module descriptions

Module number	Module name	Responsible lecturer
BIO-BP-62P01	Physiological Concepts of Microbe Cultivation	Prof. Dr. Michael Rother (michael.rother@tu-dresden.de)
<b>Qualification objectives</b>	The students know the basic processes involved in isolating microbes from the environment, they understand the physiological criteria and they are able to apply these to the applied and biotechnological context. The students are able to develop further cultivation concepts for microbes on the basis of their physiological concepts. The students know the behavior of bioreactors with different variants of process control. They are able to describe the substance transfer and transport processes in the bioreactor and select the best process control strategy for a technical problem.	
<b>Content</b>	The content of the module is the material composition and the nutrient requirements of microorganisms, their supply in natural and artificial environments as well as concepts for their enrichment, isolation and cultivation using selected examples in theory and practice. Further contents of the module are the mathematical descriptions of microbial growth, the basics for the quantitative description of the behavior of bioreactors, in particular the balancing of biomass growth and substance transfer in batch-based, feed-based or continuous cultivation, substance and energy transport processes in the bioreactor and their balancing, different reactor types as well as their fields of application.	
<b>Teaching and learning methods</b>	The module comprises lecture (2 hours per week), seminar (1 hour per week), exercise (4 hours per week), practical training (4 hours per week) and self-study.	
<b>Prerequisites for participation</b>	Basic knowledge of microbial physiology and cell biology at the undergraduate level is required. This literature is recommended as preparation: Madigan et al. (Hrsg.) Brock Biology of Microorganisms 15 <sup>th</sup> edition, Pearson Studium, ISBN 978-1-2922-3519-6.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems. The module is a prerequisite for participation in the modules From Genes to Enzymes, Systems Biology and Genomics, Introduction to Lab Research Routine, Productive Pathways, Application Technologies as well as Advanced Lab Research Routine.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of an ungraded portfolio equating to 40 hours and a written test lasting 90 minutes.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments pursuant to § 14 para. 1 sentence 5 of the Examination Regulations.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	

<b>Module duration</b>	The module comprises one semester.
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<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-62P02	Microbial Expression Hosts and Protein Production	Prof. Dr. Marion Ansorge-Schumacher (marion.ansorge@tu-dresden.de)
<b>Qualification objectives</b>	The students know the basic processes and procedures involved from the cloning of a gene to the (over)production and purification of a protein. They understand the experimental strategies for the selection of appropriate expression systems and expression organisms and they are able to use these in a biotechnological-applied context. On this basis, students are able to develop and implement appropriate expression strategies. They know the essential experimental approaches and can enrich, purify and detect target proteins. They are aware of the possibilities and limitations of different separation and analysis methods. They are able to select a method and make an error assessment.	
<b>Content</b>	The content of the module is an understanding of plasmid-based and integrative expression systems, characteristics of the microorganisms used as expression hosts (especially bacteria and yeasts), methodological knowledge on cloning, cultivation, gene expression and protein production. In addition, methods of microbial cell disruption and protein purification as well as qualitative and quantitative protein detection in theory and practice are included.	
<b>Teaching and learning methods</b>	The module comprises lecture (2 hours per week), practical training (8 hours per week) and self-study.	
<b>Prerequisites for participation</b>	Basic knowledge of microbial physiology, microbial genetics and biochemistry at the undergraduate level is required. This literature is recommended as preparation: Madigan et al. (Hrsg.) Brock Biology of Microorganisms 15 <sup>th</sup> edition, Pearson Studium, ISBN 978-1-2922-3519-6; Stryer Biochemistry, 9 <sup>th</sup> edition, Macmillan Education, ISBN 978-1-319-11465-7.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems. The module is a prerequisite for participation in the modules From Genes to Enzymes, Systems Biology and Genomics, Introduction to Lab Research Routine, Productive Pathways, Application Technologies as well as Advanced Lab Research Routine.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of an ungraded portfolio equating to 40 hours and a written test lasting 90 minutes.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-62P03	Microbial Ecology of Fungi and Protists	Prof. Dr. Martin Hofrichter (martin.hofrichter@tu-dresden.de)
<b>Qualification objectives</b>	The students know the ecological position of eukaryotic microorganisms (especially fungi and protists) in the biosphere and their interactions with inanimate and animate nature. They understand the eco-physiological background of microbial material transformation processes and know about their pivotal importance for the state of our environment. The students are familiar with examples of microbial/fungal auto-ecology. They know the forms of interactions between microorganisms and plants, microorganisms and animals as well as special interactions between fungi and insects. They have an overview of syntrophic microbial communities and know microbial corrosion of various materials.	
<b>Content</b>	The module covers basics of phylogeny, taxonomy and ecophysiology of fungi and protists as well as biogenesis, function, and properties of biominerals and biopolymers, including their significance for science and research. Microbial auto-ecology (abiotic factors temperature, water activity, pH, radiation) and antagonistic and mutualistic interactions between microorganisms, plants and animals are further contents of the module. In addition, the module includes selected processes of biocorrosion and biodeterioration as well as types of wood rot, microbial attack on concrete and steel.	
<b>Teaching and learning methods</b>	The module comprises lecture (6 hours per week), exercise (2 hours per week) and self-study.	
<b>Prerequisites for participation</b>	Basic knowledge of microbiology and ecology at the undergraduate level is required. This literature is recommended as preparation: Madigan et al. (Hrsg.) Brock Biology of Microorganisms 15 <sup>th</sup> edition, Pearson Studium, ISBN 978-1-2922-3519-6.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems. The module is a prerequisite for participation in the modules Systems Biology and Genomics, Introduction to Lab Research Routine, Productive Pathways, Application Technologies as well as Advanced Lab Research Routine.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 15 minutes per student, which takes place as a group examination with five persons.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-61P04	From Genes to Enzymes	Prof. Dr. Marion Ansorge-Schumacher (marion.ansorge@tu-dresden.de)
<b>Qualification objectives</b>	The students know the basic mechanisms of microbial regulation and signal transduction and understand how these processes can be used biotechnologically. They know the domain-specific processes involved in the translation of mRNA into proteins as well as the sequences of specific translation events. The students understand the molecular mechanisms and are able to use them in the applied/biotechnological context. They know molecular properties and applications of enzymes and understand the relationship between structure and catalytic function. They are able to identify enzyme sources and determine the technical performance of enzymes.	
<b>Content</b>	The content of the module is the molecular basis of bacterial regulation in the context of transcription and translation initiation as well as signal transduction. Further contents are the mechanistic details of the translation of mRNA into proteins in the three domains of life as well as the molecular principles of special translation processes. Furthermore, the module includes the biochemically/physiologically relevant consequences of special translation events and their biotechnological utilization using examples. The module also covers enzyme categories and their significance for applications, relationships between structural and catalytic properties of selected enzymes, and the essential characteristics of biocatalytic use. It also includes classical and modern methods of identifying new enzymes.	
<b>Teaching and learning methods</b>	The module comprises lecture (4 hours per week), seminar (2 hours per week), exercise (1 hour per week), and self-study.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation as well as Microbial Expression Hosts and Protein Production.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each winter semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-61P05	Systems Biology and Genomics	Prof. Dr. Thorsten Mascher (thorsten.mascher@tu-dresden.de)
<b>Qualification objectives</b>	Students know different types of sequence data as well as basic methods and procedures for their investigation. They understand the importance of sequence-based analysis techniques and are able to apply them in the context of exemplary tasks pertinent for biological questions. The students are able to develop hypotheses and analysis concepts based on evaluated sequence data.	
<b>Content</b>	The content of the module is sequence-based analyses, starting from microbial, fungal or plant proteome or genome data. Furthermore, bioinformatic tools for sequence analysis, visualisation and biological interpretation of the analysis results are included.	
<b>Teaching and learning methods</b>	The module comprises lecture, exercise, seminar, practical training, tutorial, research colloquium, student working groups, project, and field trip totaling 4 hours per week and self-study. The courses are to be chosen from the catalog "Systems Biology and Genomics" of the Master's degree program Molecular Biosciences and Productive Biosystems of the Faculty of Biology. This catalog including the information on the required examinations will be announced at the beginning of each semester by the Faculty. As an exception, the teaching language of the courses may be German. This will be specified by the lecturer at the beginning of each semester and announced by the Faculty.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation, Microbial Expression Hosts and Protein Production, Microbial Ecology of Fungi and Protist as well as basic knowledge of molecular genetics and genome organization at the undergraduate level. This literature is recommended as preparation: e. g. Benjamin Lewin „Genes XII“ (ISBN: 978-1284104493) or James Watson et al. „Molecular Biology of the Gene“ (ISBN: 978-0321762436, 7 <sup>th</sup> edition).	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of a graded examination assessment specified in the "Systems Biology and Genomics" catalog.	
<b>Credit points and grades</b>	Participants can earn five credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each winter semester.	
<b>Workload</b>	The workload comprises a total of 150 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-61P06	Introduction to Lab Research Routine	Dean of Studies (dekanat.biologie@tu-dresden.de)
<b>Qualification objectives</b>	The students have knowledge of specific research topics in molecular biosciences and/or productive biosystems. They have developed their professional knowledge and skills in a selected field and are able to comprehend scientific issues. They have acquired practical experience with routine scientific work and know the rules of scientific professionalism. They are able to acquire knowledge on their own through research and experimentation. In addition, they have enhanced personal competences such as time management, work planning, self-reflection, problem-solving ability and communication and teamwork skills.	
<b>Content</b>	The module includes a research topic in molecular biosciences and/or productive biosystems oriented on the current research activity of the supervising scientific institution and the persons involved in the study programme (chosen by the student). It includes the theoretical basics as well as specialised practice in experimentation, speaking and writing.	
<b>Teaching and learning methods</b>	The module comprises practical training (9 hours per week) and research colloquium (1 hour per week) and self-study.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation, Microbial Expression Hosts and Protein Production as well as Microbial Ecology of Fungi and Protists.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems. The module is a prerequisite for participation in the module Advanced Lab Research Routine.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of a complex assessment equating to 40 hours.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each winter semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-MA-AQUA1	General Qualifications	Dr. Jannette Wober (jannette.wober@tu-dresden.de)
<b>Qualification objectives</b>	The students are able to engage with socially relevant topics in a critical way or they have basic foreign language as well as communicative skills. The acquired linguistic, social and personal knowledge and skills enable them to engage in intercultural discourse and to judge and act in a socially responsible manner.	
<b>Content</b>	The module includes, at the student's choice, interdisciplinary content on topics related to life in a pluralistic and open-minded society, such as sustainability, diversity, globalization, interculturality, digitalization, culture, democracy, or similar topics. This can also include learning a language.	
<b>Teaching and learning methods</b>	The module comprises lecture, exercise, seminar, practical training, tutorial, research colloquium, student working groups, project, field trip, and language course totaling 4 hours per week and self-study. The courses are to be chosen from the catalog "General Qualifications" of the Faculty of Biology. This catalog including the information on the required examinations will be announced at the beginning of each semester by the Faculty.	
<b>Prerequisites for participation</b>	There are no specific prerequisites for participation.	
<b>Applicability</b>	This module is a compulsory module in the master's degree programs Molecular Biosciences and Productive Biosystems and Biology in Society.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of an ungraded examination assessment specified in the "General Qualifications" catalog.	
<b>Credit points and grades</b>	Participants can earn five credit points for this module. The module examination will only be graded as either "pass" or "fail".	
<b>Module frequency</b>	The module is offered each semester.	
<b>Workload</b>	The workload comprises a total of 150 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-62P07	Productive Pathways	Prof. Dr. Michael Rother (michael.rother@tu-dresden.de)
<b>Qualification objectives</b>	Students understand the thermodynamic, biochemical and bioenergetic principles of metabolic pathways. The students are able to classify the role of individual metabolic pathways in the physiological context of the respective organism, they also understand the effects of metabolic services on the environment. The students master the concepts of how metabolic performances can be exploited biotechnologically and are able to suggest the application of these, based on examples.	
<b>Content</b>	The contents of this module are metabolic principles and mechanisms of natural and artificial metabolic processes. Further contents are the effects that metabolic services (can) have on the own organism, on other organisms and the environment. This module also includes examples of selected concepts and processes of how metabolic services can be biotechnologically developed. The various characteristics of such developments are also part of the module.	
<b>Teaching and learning methods</b>	The module comprises lecture, exercise, seminar, practical training, tutorial, research colloquium, student working groups, project, and field trip totaling 8 hours per week and self-study. The courses are to be chosen from the catalog "Productive Pathways" of the Master's degree program Molecular Biosciences and Productive Biosystems of the Faculty of Biology. This catalog including the information on the required examinations will be announced at the beginning of each semester by the Faculty. As an exception, the teaching language of the courses may be German. This will be specified by the lecturer at the beginning of each semester and announced by the Faculty.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation, Microbial Expression Hosts and Protein Production as well as Microbial Ecology of Fungi and Protists.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of two examination assessments specified in the "Productive Pathways" catalog, which must both be passed.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-62P08	Application Technologies	Prof. Dr. Marion Ansorge-Schumacher (marion.ansorge@tu-dresden.de)
<b>Qualification objectives</b>	The students know technological concepts that are based on the use of organismic or molecular biological systems as productive tools. They know technical terms and experimental approaches. They understand molecular processes and relationships and are able to suggest application and adaptation strategies for biological systems. In addition, they are able to make responsible judgments and act responsibly and can critically discuss socially relevant topics.	
<b>Content</b>	The content of the module includes methodological approaches and technological backgrounds of the use of organismic and molecular biological systems in the context of the bioeconomy. The module also covers socially relevant topics.	
<b>Teaching and learning methods</b>	The module comprises lecture, exercise, seminar, practical training, tutorial, research colloquium, student working groups, project, and field trip totalling 8 hours per week and self-study. The courses are to be chosen from the catalog "Application Technologies" of the Master's degree program Molecular Biosciences and Productive Biosystems of the Faculty of Biology. This catalog including the information on the required examinations will be announced at the beginning of each semester by the Faculty. As an exception, the teaching language of the courses may be German. This will be specified by the lecturer at the beginning of each semester and announced by the Faculty.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation, Microbial Expression Hosts and Protein Production as well as Microbial Ecology of Fungi and Protists.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of two examination assessments specified in the "Application Technologies" catalog, which must both be passed.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	



<b>Module number</b>	<b>Module name</b>	<b>Responsible lecturer</b>
BIO-BP-62P09	Advanced Lab Research Routine	Dean of Studies (dekanat.biologie@tu-dresden.de)
<b>Qualification objectives</b>	The students have further knowledge of specific research topics in molecular biosciences and/or productive biosystems. They have increased their professional knowledge and skills in a second selected field and are able to comprehend scientific issues. They have acquired practical experience with the routine scientific work, which enables them to work on independent scientific projects while being familiar with the rules of scientific professionalism. They are able to deal with complex issues in a scientifically appropriate, well-founded and critical manner, to critically question results and to identify problems. They have developed a structured way of working and have further enhanced their ability to communicate and work in a team.	
<b>Content</b>	The module includes a research topic in molecular biosciences and/or productive biosystems geared towards the current research activity of the supervising scientific institution and the persons involved in the study programme (chosen by the student). The last one is different from the institution chosen in the module Introduction to Lab Research Routine. The module includes the theoretical basics as well as specialised practice in experimentation, speaking and writing.	
<b>Teaching and learning methods</b>	The module comprises practical training (9 hours per week) and research colloquium (1 hour per week) and self-study.	
<b>Prerequisites for participation</b>	Participants require skills acquired in the modules Physiological Concepts of Microbe Cultivation, Microbial Expression Hosts and Protein Production, Microbial Ecology of Fungi and Protists as well as Introduction to Lab Research Routine.	
<b>Applicability</b>	This module is a compulsory module in the master's degree program Molecular Biosciences and Productive Biosystems.	
<b>Requirements for earning credit points</b>	Credit points are earned after passing the module examination. The module examination consists of a complex assessments equating to 40 hours.	
<b>Credit points and grades</b>	Participants can earn ten credit points for this module. The module grade corresponds to the grade of the examined assessment.	
<b>Module frequency</b>	The module is offered each summer semester.	
<b>Workload</b>	The workload comprises a total of 300 hours.	
<b>Module duration</b>	The module comprises one semester.	

## Annex 2: Study schedule

with type and scope of courses given in hrs/week as well as required work, the type, scope and format of which can be found in the module descriptions

Module number	Module name	1 <sup>st</sup> Semester	2 <sup>nd</sup> Semester	3 <sup>rd</sup> Semester (M)	4 <sup>th</sup> Semester	CP
		L/E/S/P	L/E/S/P/T/RC/SW/Pr/F/LC	L/E/S/P/T/RC/SW/Pr/F		
BIO-BP-62P01	Physiological Concepts of Microbe Cultivation	2/1/1/4 2xEx				10
BIO-BP-62P02	Microbial Expression Hosts and Protein Production	2/0/0/8 2xEx				10
BIO-BP-62P03	Microbial Ecology of Fungi and Protists	6/2/0/0 Ex				10
BIO-BP-61P04	From Genes to Enzymes		4/1/2/0/0/0/0/0/0 Ex			10
BIO-BP-61P05	Systems Biology and Genomics <sup>1</sup>		*/*/*/*/*/*/*/*/* Ex			5
BIO-BP-61P06	Introduction to Lab Research Routine		0/0/0/9/0/1/0/0/0 Ex			10
BIO-MA-AQUA1	General Qualifikations <sup>2</sup>		*/*/*/*/*/*/*/*/* Ex			5
BIO-BP-62P07	Productive Pathways <sup>3</sup>			*/*/*/*/*/*/*/*/* 2xEx		10
BIO-BP-62P08	Application Technologies <sup>3</sup>			*/*/*/*/*/*/*/*/* 2xEx		10
BIO-BP-62P09	Advanced Lab Research Routine			0/0/0/9/0/1/0/0/0 Ex		10
					Master Thesis Colloquium	29 1
<b>CP</b>		30	30	30	30	120

\* depending on choice made by the student

<sup>1</sup> The module compromises L, E, S, P, T, RC, SW, Pr and F totaling 4 hours per week according to the catalog Systems Biology and Genomics.

<sup>2</sup> The module compromises L, E, S, P, T, RC, SW, Pr, F and LC totaling 4 hours per week according to the catalog General Qualifications.

<sup>3</sup> The module compromises L, E, S, P, T, RC, SW, Pr and F totaling 8 hours per week according to the catalog Productive Pathways resp. Application Technologies.

M	Mobility window according to § 6 para. 1 sentence 3 Study Regulations
CP	Credit Points
L	Lecture
E	Exercise
S	Seminar
P	Practical training
T	Tutorial
RC	Research colloquium
SW	Student working groups
Pr	Project
F	Field trips
LC	Language course
Ex	Examination(s)