

# Degree Program Documentation

## Bachelor's Program

### Life Sciences Biology

Part A  
TUM School of Life Sciences  
Technical University of Munich

## General information:

- Administrative responsibility: TUM School of Life Sciences
- Name of degree Program: Life Sciences Biology
- Degree: Bachelor (B.Sc.)
- Standard duration of study and credits:  
6 Semester of enrollment and 180 credit points (CP)
- Form of study: Full-time
- Admission: Study orientation procedure (SOV)
- Start: Winter semester (WiSe) 2019/20
- Language: German
- Main location: Weihenstephan (Freising)
- Academic administrator (program design):  
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# 1 Degree Program Objectives

## 1.1 Purpose

Biology is at the center of the life sciences, which is not without reason called the leading science of the 21st century. Biology is the study of living systems and integrates physical and chemical processes in a highly complex dynamic system, the living cell; this in turn is integrated into the meta-systems of the organ, the organism and finally the ecosystem. Feedbacks exist at all levels and on all time scales - from oscillations in the brain to gene regulatory networks and evolutionary processes. Biology claims to represent these life processes in their entirety and aims at a profound understanding of complexity at all levels. The central aim of the degree program is to introduce students to this universal basic approach of biology and thus provide them with the tools to contribute to the major issues of society, such as sustainability, *One Health*, food security, climate-related changes in ecosystems or the fight against (new) diseases, for example with new vaccines, in an academically profound and practically solution-oriented manner.

Nowadays, major scientific advances are being made less in the traditional natural sciences and more at the interfaces between traditional disciplines, not only at the interdisciplinary level, but especially at the level of transdisciplinary research. As the most interdisciplinary natural science, biology is ideally suited to such tasks. These are diverse and range from basic research, e.g. on previously incurable or new diseases, to biotechnology and microbial cell factories, from systemic approaches to individualized diagnostics and medication to securing the world's food supply through animal and plant breeding, from the recording and preservation of biodiversity and ecosystems to dealing with neophytes and neozoa, and from the microbiome to the challenges of neurobiology at the interface between perception, processing and control to human-machine communication. Biologists are particularly well prepared to orient themselves in these complex and interacting future fields. Understanding, predicting and influencing the interdependencies of these research areas, each of which is characterized by a specific temporal and spatial scale, will determine the success of the innovations resulting from the One Health concept in the future.

In recent years, the means and methods for studying and developing such complex, interconnected systems have also changed. With the help of technological advances, biology in the 21st century is entering the era of big data, which makes it possible to better integrate diverse study results and decipher the underlying mechanisms that operate at different levels - from the cell to the ecosystem. These include, for example, so-called "-omics" (decoding the genome, epigenome, transcriptome and proteome of individual cells up to thousands of crops or animals), medical imaging or *real-time tracking* of physiological changes in plant and animal cells as well as soil and climate conditions. It is therefore essential that biologists also acquire key skills from related scientific fields (mathematics, statistics, bioinformatics and the processing of big data).

The aim of the Bachelor's degree program in Life Sciences Biology is to build on the bioscientific knowledge acquired at school to provide a solid foundation for the visionary goals of biology. The increasingly systemic approach to bioscientific issues and the associated transdisciplinary work at the interfaces creates a high demand for suitably qualified specialists on the job market. In the current era of climate change and the global changes of the Anthropocene, an understanding of interdisciplinary, complex and dynamically connected systems will be a fundamental prerequisite for the

work of biologists in order to contribute to the goals of One Health and the achievement of a sustainable way of life.

## 1.2 Strategic Significance

The TUM School of Life Sciences at the Weihenstephan campus researches and teaches across scales, from molecular and cellular systems of microbial, plant and animal organisms to sustainable, ecosystem-wide land use strategies. Biology is the center for many natural science disciplines and thus the generative heart and engine of many developments in these fields. It constantly demands new techniques from chemistry, physics, mathematics and engineering and integrates them to answer current bioscientific questions and applications such as biohybrid sensors, large-scale fermentation plants or the handling of "big data" in medicine and agricultural science. Thanks to its broad canon of subjects and existing core competencies in the natural sciences, TUM has excellent prerequisites for shaping and further developing biology as a strong interdisciplinary research and education focus. With responsibility, talent and scientific and technological excellence, TUM strives to play a leading role in the sustainable transformation of society and innovative value creation in order to enable prosperity in harmony with nature and the environment.

With the **TUM Sustainable Futures Strategy 2030**, TUM aims to become a shaper of sustainable development - scientifically, economically, ecologically and socially. The Life Sciences Biology degree program is committed to TUM's mission statement and makes a significant contribution to the implementation of its sustainability strategy in teaching. The program focuses on aspects of social transformation for sustainable and climate-resilient development. To this end, it deals with issues such as the sustainable protection of ecosystems. Students are also supported in developing their own understanding of sustainability. Competencies for data- and evidence-based, sustainable action are exemplified in all practical courses and are also mentioned in the theoretical courses as an objective for research, such as the breeding of drought-resistant plants, the development of cell culture-based meat and the development of water protection concepts for domestic waters.

**At TUM level:** Biology is one of the central pillars of TUM's major research objectives, such as: "Foundations of Life", "Medicine and Health" and also "Sustainable Habitat" and "Sustainability". This connecting function is also reflected in various collaborations and close contacts. For example, there is good networking with the chairs and institutes of the School of Medicine and Health, especially with the departments that are strongly research-oriented (some of which are affiliated with the TUM School of Life Sciences). There is also a close exchange with the School of Natural Sciences and the School of Computation, Information and Technology at the TUM campus in Garching. At a scientific level, there are close links with the Munich Institute of Biomedical Engineering - TUM. In addition, in cooperation with the TUM School of Social Sciences and Technology, awareness of the social challenges underlying technical progress in biology is being raised. This broad network ensures that students of Life Sciences Biology are confident in the fundamentals of life and the biological processes that build on them at the chemical and cellular level, that they understand the complex interrelationships of ecosystems and their vulnerability and also see the broad application possibilities of this knowledge in medicine, ecology, microbiology and animal and plant sciences. This results in a deep basic understanding of how to deal with existing resources in an appreciative manner and

how to create opportunities to conserve or replace them where possible through sustainable developments or even to develop them in a forward-looking, ecologically and bioeconomically sensible way.

**At the level of the TUM School of Life Sciences:** Biology is the science that has an impact on all departments of the TUM School of Life Sciences. It is therefore the center from which research and application-oriented questions from other disciplines are drawn. The all-encompassing research field of *One Health is fully covered* here at the TUM School of Life Sciences by the Bachelor's degree program in Life Sciences Biology. This is also reflected in the breadth of the Bachelor's thesis topics of graduates; in many cases these are carried out in the application-related areas. The participating chairs are also located in all three departments of the School - Department of Molecular Life Sciences, Department of Life Science Systems and Department of Life Science Engineering - and are therefore an integral part of many life science-oriented working groups. In addition, many modules of the Bachelor's degree program in Life Sciences Biology are also attended by students of other degree programs of the TUM School of Life Sciences, in particular Forest Science and Resource Management, Agricultural Sciences and Horticultural Sciences, Landscape Architecture and Landscape Planning, but also, for example, Nutritional Science, and *vice versa*. Many modules of the Bachelor of Life Sciences Biology are also taken by students on the teacher training courses (B.Sc. and M.Sc. Natural Science Education and Vocational Education). As a result, the content is also formative for the STEM education of future generations of pupils.

The Bachelor of Life Science Biology also paves the way for various further training programs at TUM. Biologists can begin the equally broad-based consecutive Master's program in Biology, but can also switch to one of the other biology-related Master's programs at the TUM School of Life Sciences or at the TUM Campus Straubing. Furthermore, depending on the differentiation in the required elective area, other courses of study with a bioscience focus are also possible within and outside TUM.

## 2 Qualification Profile

The content of the following qualification profile corresponds to the requirements of the Qualifications Framework for German Higher Education Qualifications (Hochschulqualifikationsrahmen - HQR) and the requirements contained therein (i) knowledge and understanding, (ii) use, application and generation of knowledge, (iii) communication and cooperation and (iv) academic self-conception/professionalism. The formal aspects according to the HQF (admission requirements, duration, degree options) are detailed in chapters 3 and 6 as well as in the corresponding subject examination and study regulations.

These qualifications and skills are achieved through lectures on basic knowledge, practicals and exercises to "work through" and also understand what they have heard and seminars to exchange, discuss and also develop their own thoughts and opinions. Students work in small groups to develop solutions to the tasks set for them, whereby different views and opinions are also considered in an appreciative manner and challenged with the knowledge they have acquired.

## **Knowledge and Understanding**

After successfully completing the Bachelor's degree program, graduates will have acquired orientation knowledge and practical skills in the following fields of biochemistry/bioanalytics, zoology, botany, microbiology, genetics, physiology, ecology and evolutionary biology. They know and understand control processes and feedback loops from the genetic, molecular and physiological to the organismic level and are able to understand their development through evolutionary processes. In addition, they can demonstrate scientific foundations in chemistry (inorganic, organic and physical), physics, mathematics/statistics and bioinformatics.

## **Use, Application and Generation of Knowledge**

Graduates understand biological processes at any level and can trace them back to the underlying chemical and physical principles. At the same time, they are able to assess the consequences for higher organizational levels down to the ecosystem level. They have the ability to penetrate a limited scientific project in terms of content and methodology, to create and carry out an experimental approach, to analyze and evaluate the results, to present the results in writing and to place them in the context of the relevant literature. In addition, they have a basic knowledge of the theoretical and practical range of methods used in the biological sciences and can develop and carry out appropriate experimental approaches to investigate biological phenomena and analyze and evaluate the results.

## **Communication and Cooperation**

Graduates are able to work successfully in a group and communicate their results. They are able to recognize interdisciplinary and transdisciplinary problems and work on them in interdisciplinary teams.

Graduates are able to use this knowledge to deal with given questions from the broad field of life sciences biology. They know the technical terms and technical basics and can use these in the field in an appropriate way to answer questions, current topics and news to an interested audience. They know the areas of application of life sciences biology in industry and research (e.g. drug development, clinical research, enzyme optimization, preservation of ecosystems, etc.) and are able to familiarize themselves with new biological tasks and biological phenomena with research and/or social relevance under supervision and to work on them with technical and methodological plausibility in accordance with the current state of science. By learning the basic rules of modern biotechnological and biochemical analysis methods and using their knowledge of molecular biological and biochemical principles and analytical methods, they are able to explain and correctly evaluate experimental results, assign them to individual biological processes, interpret them, evaluate the results obtained and classify them in a scientific context.

## **Scientific Self- Conception and Professionalism**

Graduates are able to apply a wide range of scientific methods to abstract and analyze the basic structure of biological problems. They have acquired specialist and methodological knowledge that allows them to assess the possibilities and limitations of scientific approaches. In addition, they are able to independently acquire new knowledge from the relevant subject areas.

In addition, a Bachelor's degree in Life Sciences Biology meets the requirements for continuing the program as a Master's degree in Germany or worldwide. The following list only contains examples from the local environment, as there is compatibility with almost all biology-related Master's degree programs worldwide.

Table 1: Complementary Master's degree programs in the regional environment

Name of the Master's program	University/School
M.Sc. Biology	TUM School of Life Sciences
M.Sc. Nutrition and Biomedicine	TUM School of Life Sciences
M.Sc. Molecular Biotechnology	TUM School of Life Sciences
M.Sc. Sustainable Resource Management	TUM School of Life Sciences
M.Sc. Neuroengineering	TUM School of Life Sciences
M.Sc. Biochemistry	TUM School of Life Sciences
M.Sc. Systemic Neuroscience	Ludwig Maximilian University of Munich

## 3 Target Groups

### 3.1 Target Audience

In the context of the above-mentioned aspects, the Bachelor of Life Sciences Biology is a universally oriented degree program. It is therefore of interest to students with a general interest in biological issues, for whom the pursuit of comprehensive knowledge of living nature is paramount and for whom the interest in implementation in a specific area of application only crystallizes in the course of their studies.

The Bachelor's degree program in Life Sciences Biology is aimed at high school graduates who have a high affinity for biological issues and a great interest in scientific subjects. An enjoyment of analyzing complex systems, an appreciation of the intellectual acquisition of knowledge and a fascination with the wide range of biological organisms and systems are also required.

### 3.2 Prerequisites

For the Bachelor's degree program in Life Sciences Biology, the general admission requirements for studying at a university must be fulfilled in accordance with the Ordinance on Qualifications for Studies at Universities of the Free State of Bavaria and State-recognized non-state universities (Qualification Ordinance-QualV) (BayRS 2210-1-1-3-K/WK) as amended. It is an advantage if the focus of the school education was in the natural sciences. The degree program is also open to international students, however, sufficient German language skills must be demonstrated. The regulations for this are defined in the [application information portal](#).



As a consequence of the content profile of the degree program and its requirements, students must be motivated and capable of learning the basics as well as penetrating the diversity and complexity of biological systems. For this reason, the special aptitude of applicants must be demonstrated in the first two semesters with basic and orientation examinations (GOP).

### 3.3 Target Numbers

The Bachelor's degree program is designed for 180 first-year students. The number of prospective students is consistently high with over 600 applications. The Bachelor's degree program in Life Sciences Biology is of interest to foreign students despite being largely taught in German, with the proportion of foreign students fluctuating between 15 and 30%.

The ratio between applicants, suitable applicants and ultimately enrolled students has changed constantly in the past. Of the more than 600 applicants, around 80% were admitted to the program, of which around 35% accepted the place. In view of the fact that prospective students apply to many universities at the same time and the very good candidates in particular also receive acceptances from many locations, this acceptance rate demonstrates the high attractiveness of Weihenstephan as a location.

Figure 1: Applications, admissions and enrollments in the Bachelor's degree program in Life Sciences Biology in relation to the respective winter semesters

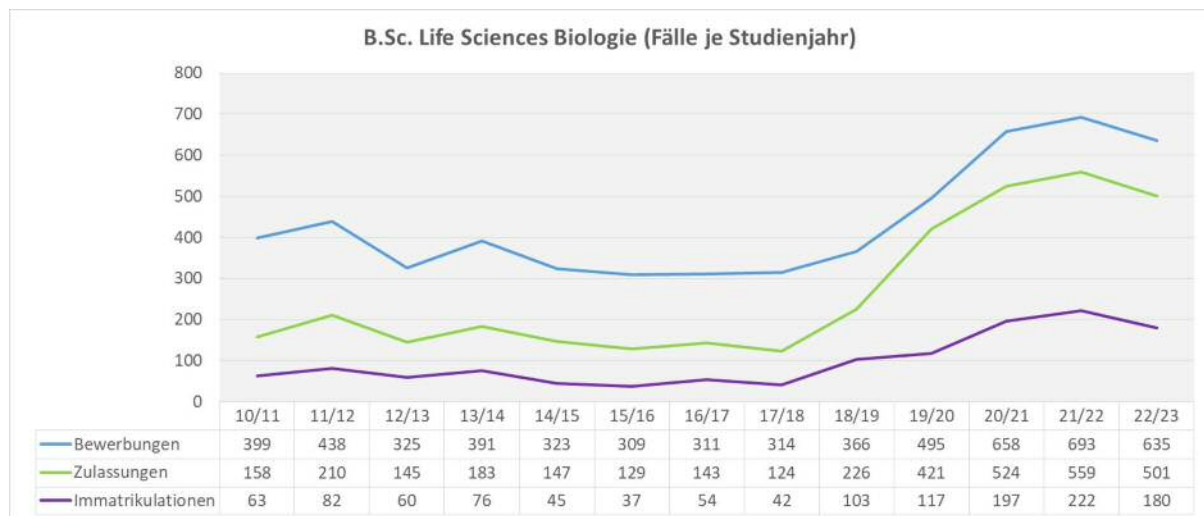


Table 2: Bachelor's degree program in Life Sciences Biology by gender and origin in the winter semester 2022/2023 (source: TUM indicator system)

Total students	thereof male	female	German	Foreigners	Educational nationals	Education foreigners
341	115	226	279	62	13	49

## 4 Demand Analysis

In principle, it is possible to enter professional life after completing the Bachelor's degree, as graduates are qualified for a range of different professional fields:

- Collaboration in research projects in industry and public research institutions
- Qualification for in-house trainee programs
- Expert processing in specialist reports to authorities, e.g. on biological issues
- Scientific input for environmental reports (authorities and consulting offices)

However, almost all Bachelor's graduates aim for a Master's degree at the beginning of their studies in order to further qualify themselves for the job market and/or a subsequent doctorate. The broad basic training and the individually selectable differentiation enables graduates to apply for a Master's degree in Biology or a related field such as Molecular Biotechnology, Nutritional Science or other biology-related programs at TUM (e.g. Agricultural and Horticultural Sciences, Landscape Architecture and- planning) or at another university in Germany or abroad for thematically narrower Master's programs such as Environmental Sciences, Microbiology, Marine Biology or Biomedicine. The program will enable future graduates, as well as graduates of the previous Bachelor's degree program in Biology at TUM, to enter a Master's degree program and gain further professional qualifications.

In this context, it should be noted that the consecutive nature of the Bachelor's/Master's degree program is generally well known to first-year students in the German labor market: most students (over 60%) were already planning to study for a Master's degree before starting their Bachelor's degree program.

## 5 Competition Analysis

The enormous penetration of biological aspects into everyday life and their significance for the future of mankind have led to the establishment of a large number of bioscientific research fields and thus also fields of study. The number of degree programs with bioscientific content is now barely comprehensible even for specialists and requires explanation even within a university. In these areas, which are mostly geared towards specific fields of application, the complexity of the overall biological view is reduced to specific aspects in order to carry out targeted research. For prospective students, this early differentiation is not only difficult to grasp, but also forces them to make a difficult decision at a time when most have at best developed a general inclination for a field.

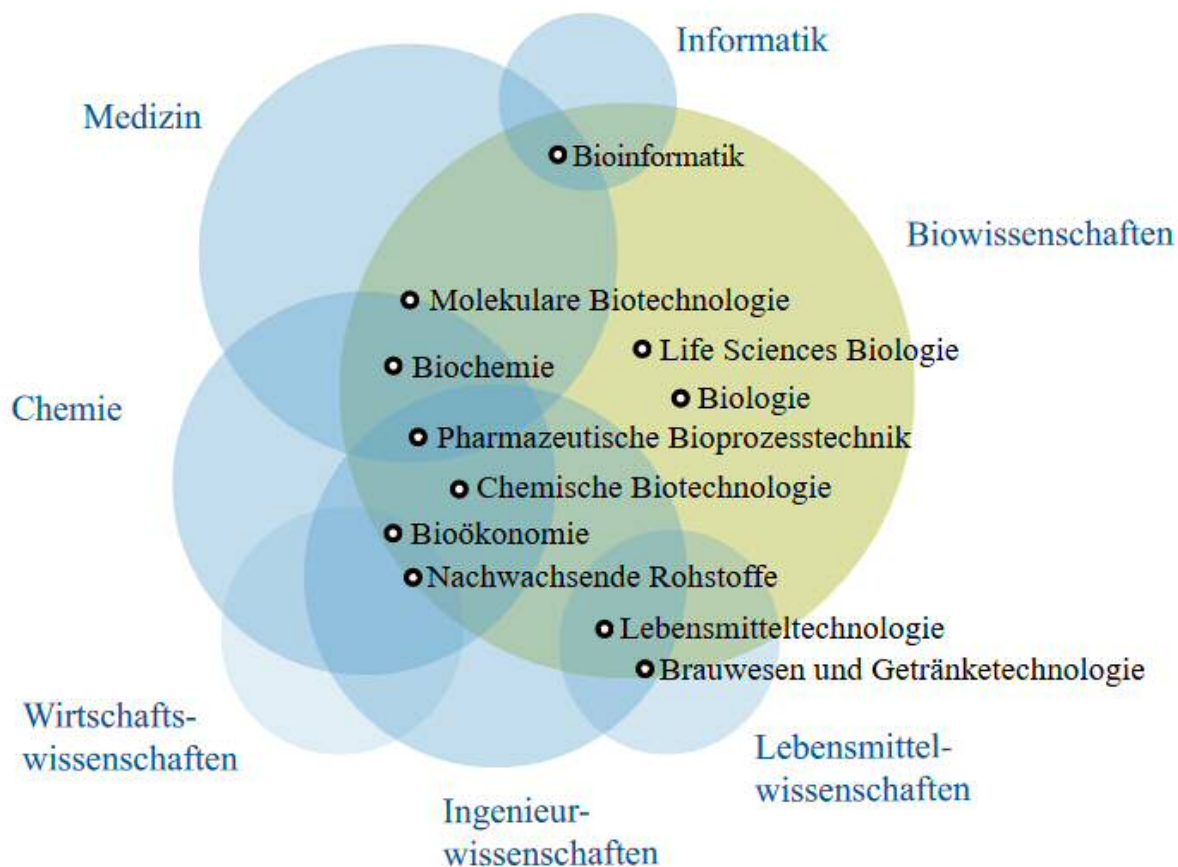
### 5.1 External Competition Analysis

It is possible to study biology at almost every major university in Germany and abroad. An external competitive analysis is therefore not expedient at this point. Due to the very high level attested by international rankings, the Bachelor's degree program in Life Sciences Biology at the Technical University of Munich is also in great demand internationally. The program is among the top 50 with Oxford, Cambridge, ETH Zurich and Paris Saclay, to name but a few. The smaller course sizes and the resulting more intensive supervision compared to many other universities also contribute to the reputation of the program.

## 5.2 Internal Competition Analysis

As described at the beginning, biology is the central subject of the life sciences. Based on biological content, a large number of degree programs have been created at the Technical University of Munich that transfer biological knowledge into technical, medical or food technology fields of application as early as the Bachelor's level. As this diversity is difficult to keep track of for prospective students, the following information graphic has been created:

Figure 2: Overview of the Biosciences degree programs at TUM



In addition, the School of Life Sciences offers a number of Bachelor's degree programs that do not have the term "Bio" in their title, but also draw on a biological core curriculum.

Table 3: Bachelor's degree programs with a biology-related focus at the School of Life Sciences

<b>Name of the study program</b>	<b>School</b>
B.Sc. Agricultural and Horticultural Sciences	TUM School of Life Sciences
B.Sc. Life Sciences Nutrition	TUM School of Life Sciences
B.Sc. Molecular Biotechnology	TUM School of Life Sciences

<b>Name of the study program</b>	<b>School</b>
B.Sc. Forest Science and Resource Management	TUM School of Life Sciences
B.Sc. Pharmaceutical Bioprocess Engineering	TUM School of Life Sciences
B.Sc. Brewing and Beverage Technology	TUM School of Life Sciences
B.Sc. Landscape Architecture and Landscape Planning	TUM School of Life Sciences

In contrast to these degree programs, which are aimed at a specific translation right from the start, the Bachelor of Life Sciences Biology is deliberately broadly based and covers the entire field of biology. This makes the program attractive to first-year students who are interested in basic research in biology or who have not yet decided on a specific field of application. In competition with the other degree programs, this basic research approach leads to an ostensibly poorer fit with the respective specialized fields of application, but on the other hand, due to the greater breadth, to universal applicability and the introduction of new research aspects and methods. The attractiveness of this concept is also demonstrated by the net inflow from other Bachelor's degree programs into the broad-based Master's degree.

## 6 Program Structure

The Bachelor's degree program in Life Sciences Biology is organizationally and professionally based at the School of Life Sciences at TUM. It deliberately provides students with a broad basic orientation in the life sciences without narrowing their focus to specific application aspects at an early stage. Building on the teaching of mathematical, physical and chemical fundamentals, a balanced introduction to all relevant biological disciplines is provided. This also includes a broad overview of methodological approaches and technological advances in the study of living systems. In later semesters, the integrative approach is promoted and, at the same time, the students' personal strengths are differentiated through elective courses. In addition to this orientation competence, the ability to analyze and abstract complex biological systems and interrelationships and to develop questions and solutions is also taught in general.

The Bachelor of Life Sciences Biology program comprises six semesters. While the first four semesters have a largely fixed timetable, the fifth and sixth semesters consist almost exclusively of elective modules and the writing of the Bachelor's thesis.

The courses in the first four semesters provide a structured introduction to the basics and applications of bioscientific topics. In addition to the logic of acquiring knowledge, the motivation and self-image of the students is also taken into account; therefore, a consecutive introduction to living nature from simple organisms to ecosystems takes place parallel to the necessary teaching in the accompanying sciences.

The courses in the first semester consist of large foundation modules in which the basic knowledge of the important accompanying sciences (inorganic chemistry, physics, mathematics) is taught. This acquisition of knowledge is accompanied by coordinated exercises and practicals in which the understanding of the fundamentals is practiced and tested by applying it to specific experimental problems. At the same time, an introduction to living organisms (the basis for zoology and botany) takes place; here, building on the knowledge acquired, a comparative examination of different forms is carried out in order to practise classifications and generalizations. In order to provide a clear link to

practice right from the start, the module "Hot Topics in Life Sciences" discusses current biological topics with the students from various perspectives. The smaller module (2 CP) is considered to be particularly important so that, in addition to the predominantly basic-oriented teaching in the first semester, students also become familiar with current topics in biology with social relevance and acquire the ability to discuss these controversially. The concept with changing venues also serves to orient students on campus and to familiarize them with directions that are not included in the basic canon.

In the second semester, the chemical training is expanded to include more complex organic and physical chemistry and is also consolidated through a practical course. The introduction to "Genetics and Cell Biology" transfers these fundamentals to living nature. Here, students apply the acquired basics to successively more complex cellular processes and learn about the genetic level of regulation. In the area of plants and fungi, students also gain an initial deeper insight into the blueprints of organisms and their cell organization in both theory and practical exercises. Finally, in the "Ecology, Evolution and Biodiversity" module, the organismic approach of the first semester is transferred to the level of ecosystems and the mechanisms are analyzed. In addition, the first foundations in statistics are laid and the mathematics of the first semester is applied to concrete examples.

In the third semester, cell biology knowledge is applied at the level of single-cell organisms in the "Microbiology" module and the "Developmental Biology" module covers and generalizes the molecular basics of pattern formation in plant and animal organisms. In the field of mathematics, the module "Bioinformatics" follows, which primarily prepares students for later work with databases. In this semester, the module "Fundamentals of Biochemistry and Energy Metabolism" begins with the basics of biochemistry. Due to the greater complexity, the structure of the animal organism is fundamentally presented in the third semester in the module "Structures, Tissues and Functions in Animals". This subject area is accompanied by the module "Plant Psychology", which builds on this and also examines these processes in plants in more detail.

The fourth semester focuses on the topic of (molecular) physiology in the animal organism ("Human and animal physiology"). In the field of biochemistry, the focus is on biochemical processes in cells and deals with "energy metabolism". The semester also consists mainly of practicals: In the "Biochemistry and Bioanalytics" module, the practice of biochemical and bioinformatics methods is practiced and in the "Fundamentals of Genomics and Genetic Exercises" module, basic genetic knowledge is implemented in an experimental context and expanded to include genomics. In "Applied Data Science", the knowledge gained from statistics, bioinformatics and research practice can be applied to the analysis of larger amounts of data. The overview and analysis of different types of "-omics" data play a major role here. The module "Practical bioscientific research" serves as preparation for the thesis and previous possible research internships etc.

The fifth semester consists entirely of elective modules and therefore functions as a mobility window.

In the sixth semester, further freely selectable elective modules are completed for both subject-specific and interdisciplinary qualification. Before beginning the Bachelor's thesis, students should once again gain an integrative view of the connections between the various subject areas, which is characteristic of biology, and learn to put this into practice. To this end, the relationships between biochemistry and cell biology, functional anatomy and physiology are analyzed and discussed on both plant and animal organisms and scientific questions and suitable physiological experiments (within the elective modules) are developed.

Figure 3: Exemplary curriculum of the Bachelor's degree program Life Sciences Biology

Semester	Modules						Exams/ Credits
1.	CH0142 General and in-organic Chemistry with Laboratory Course (GOP) K 10 CP	WZ0089 Introduction to Biology of Organisms (GOP) K 6 CP	MA9601 Advanced Mathematics 1 (GOP) K 5 CP	PH9034 Physics for Life Sciences (compulsory) K + LL 7 CP	LS20028 Hot Topics in Life Sciences (required) B (SL) 2 CP		6 30
2.	WZ0128 Introduction to Genetics and Cell Biology (GOP) K 6 CP	LS20024 Diversity and Evolution of Plants and Fungi (required) K 5 CP	NAT0144 Phys. Chemistry w. Chemical Laboratory Course (required) K 7 CP	WZ0127 Introduction to Ecology, Evolution and Biodiversity (required) K 5 CP	CIT5130005 Introduction to Stochastic Models and Statistics (required) K 5 CP	WZ0013 Organic Chemistry (required) K 3 CP	6 31
3.	WZ2634 Introduction to Bioinformatics (required) K 5 CP	LS20029 Introduction to Microbiology with Exercises (required) K + LL 6 CP	WZ0159 Introduction to Structures, Tissues and Functions in Animals (required) K 5 CP	WZ0024 Plant Physiology (required) K 4 CP	WZ0144 Introduction to Developmental Biology (required) K 5 CP	WZ0130 Introduction to Biochemistry and Metabolomics (required) (5)	6 30
4.	WZ0161 Introduction to Genomics and Practical Course in Genetics (required) K 7 CP	WZ0166 Basic practical course Biochemistry and Bioanalytics (required) LL 5 CP	WZ0214 Doing Research in Biosciences (required) K 3 CP	WZ0022 Human and Animal Physiology (required) K 6 CP	LS20025 Applied Data Science in the Life Sciences (required) PA 5 CP	K (3) 8 CP	6 29
5.	WZ1082 Fish Biology and Aquaculture (Specialization Ecology) K 5 CP	WZ2615 Diversity and Evolution of Mosses (Specialization plant) PRE 5 CP	WZ3096 Scientific Computing for Biological Sciences with Matlab (Specialization Animal) K 3 CP	LS30003 Food Microbiology (Specialization Microbiology) K + LL 5 CP	WZ2517 Advanced Methods in Experimental Design (Specialization Genetics and Biochemistry) B 10 CP	WZ2577 Functional Diversity of Animals (Specialization Animal) (2)	6 30
6.	WZ2674 Challenges of Biomedicine. Social, Political and Ethical Aspects of Medical Biology (ÜFQ) B 5 CP	LS90000 Bachelor's thesis (required) W 12 CP		LS20030 Design of Experiments and Statistics for Biological Data (Specialization Ecology) K 5 CP	WZ2530 Plant Pathology and Diagnostics (Specialization plant) K 5 CP	K+LL (3) 5 CP	6 30



Dark blue = required Bachelor's thesis module  
 Light blue = elective modules  
 Grey = required modules  
 Green = basic and orientation examination (GOP)  
 Orange = interdisciplinary qualification

UE = exercise; PR = practical course; CP = credit points;  
 SL = academic achievement; K = written exam;  
 LL = laboratory work; B = report;  
 W = scientific paper  
 PA = project work; PRÄ = presentation

## 7 Organization and Coordination

The Bachelor's degree program in Biology is offered by the TUM School of Life Sciences.

For administrative aspects of study organization, the central departments of the TUM Center for Study and Teaching (TUM CST) and the TUM School of Life Sciences/Campus Office Weiherstephan are responsible (see overview below):

- Student Advising: Student Advisory Service and Information Services (TUM CST)  
 (via Hotline/Service Desk)  
[studium@tum.de](mailto:studium@tum.de)  
 +49 (0)89 289 22245
- Departmental Student Advising: Team Student Advising  
 Dr. Michael Scharmann, Tel: +49 (0)8161 71 3804  
[Contact form](#) Campus Office Weiherstephan
- Student Office, Infopoint: [Contact form](#) Campus Office Weiherstephan
- Study Abroad Advising/  
 Internationalization: TUM-wide: TUM Global & Alumni Office  
[internationalcenter@tum.de](mailto:internationalcenter@tum.de)  
 Departmental: Student Counselling Team  
[Contact form](#) Campus Office Weiherstephan
- Gender Equality Officer: Prof. Aphrodite Kapurniotu  
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 Application, enrollment, student card,  
 leave of absence, re-registration, de-registration

- Aptitude Assessment: TUM-wide: Application and enrollment (TUM CST)  
Departmental: Student Advisory Service Team  
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- Semester Fees and Scholarships: TUM-wide: Fees and Scholarships (TUM CST)  
[beitragsmanagement@zv.tum.de](mailto:beitragsmanagement@zv.tum.de)
- Examination Office: TUM-wide: Central Examination Office (TUM CST)  
Departmental: Team Examination  
[Contact form](#) Campus Office Weihenstephan
- Examination Board: Prof. Dr. rer. nat. Johan Philipp Benz (Chairman)  
Ivan Babic (Secretary)
- Quality Management Studies and Teaching: TUM-wide: Studies and Teaching -  
Quality Management (TUM CST)  
[www.lehren.tum.de/startseite/team-hrs/](http://www.lehren.tum.de/startseite/team-hrs/)  
Departmental: Quality Management Team  
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## 8 Enhancement Measures

Biology is one of the central pillars of TUM's major research goals, such as "Fundamentals of Life", "Medicine and Health" and also "Sustainable Habitat" and "Sustainability". To enable biologists to play their central role in these topics in the 21st century, two key changes have been made to the Bachelor's degree program in Life Sciences Biology. This takes account of key developments, the omnipresent importance of new "omics" technologies and the emergence of new research topics.

On the one hand, practical learning in statistics and data science will be strengthened. Specifically, this will be implemented through additional/modified modules in the first four semesters and an increased range of data science elective modules in the fifth and sixth semesters. The mathematics course in the first semester will focus on the fundamentals of mathematical models underlying biological phenomena. The now independent statistics module in the second semester will focus on the basis of statistical analysis. This will give students more practice time to learn the R software - a must in modern biology. The "Bioinformatics" module and the newly added "Applied Data Science in the Life Sciences" module provide a well-rounded overview of "-omics" data and the basics for dealing with such extensive data sets, with increased practice and practical application.

Secondly, the vertical structure of knowledge acquisition across semesters will be improved for each of the five focus areas of genetics and biochemistry, microbiology, ecology, plant sciences and animal sciences. For each specialization, a structure consisting of basic modules in the first and second semesters, in-depth modules in the third and fourth semesters, and elective modules in the fifth and sixth semesters will be implemented. This also means that large modules are divided into smaller 5 ECTS units that have a condensed, coherent focus. The "Biochemistry" module will be moved to the



third and fourth semesters in order to build on the introduction to physics and biochemistry from the first two semesters.

A new module on "Diversity and Evolution of Plants and Fungi" (5 ECTS) is offered in the second semester to provide students with an extended overview and practical experience in dealing with these organisms and their anatomy. Building on this, the module "Plant Physiology" (5 ECTS) is now offered in the fourth semester, providing in-depth knowledge of molecular and biochemical mechanisms. These two modules form the counterpart to the two modules from the animal sciences "Basic Practical Course Structures, Tissues and Functions in Animals" (3rd semester) and the module "Human and Animal Physiology" (4th semester). This new structure serves to better prepare students for the specializations in the consecutive Master's degree program (Biochemistry/Cell Biology, Genomics Biostatistics, Medical Biology, Microbiology, Ecology/Environmental Management, Plant Sciences, Animal Sciences).

The Bachelor's thesis now forms the final part of the program with 12 CPs. The scientific project presentation, together with the Bachelor's colloquium, is no longer required in favor of other elective modules in the new Bachelor's degree program in Life Sciences Biology.

If you look at the development of the Bachelor's degree program from Biology to Life Sciences Biology over the last few years, you can see that the program has evolved from its original biological foundations to a more contemporary, methodologically modernized program. The original strong focus on systematics and pure ecology has shifted to a more comprehensive view, the systemic connections from the cell to the organism and the corresponding methodological and analytical possibilities, including the greatly increased demand for biostatistics and data management.

The characteristics of the TUM Bachelor's degree program in Life Sciences Biology, the horizontal structure of the knowledge link between the disciplines and the broad range of skills, which have been established since its inception in 2019, will be maintained. Combined with the selective adjustments, graduates of the Bachelor's degree program in Life Sciences Biology are thus at the pulse of current bioscientific issues and can contribute their extensive knowledge in a variety of ways for the benefit of society.